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ARTIFICIAL TRANSMISSION LINE.

The favorite method of treating the general alternating-current transformer is to consider it equivalent in electrical input and output characteristics to two inductive impedances in series to represent its primary and secondary coils with their magnetic leakage fields and an inductive impedance shunted across between these impedances to represent the main magnetic circuit. Determinations based on the equivalent electric circuits of the transformer indicate normal and overload operating characteristics which agree with the actual service-performance of the apparatus to a degree of accuracy that can well be considered as practically perfect. However, abnormal conditions in transformer service, such as voltage at break-down, cannot be dealt with by means of equivalent electric circuits, and hence the equivalent circuits are handled as mathematical fictions rather than reduced to construction as an artificial reproduction of the physical reality. In a like manner the normal operating characteristics of a transmission line can be determined most accurately by assuming the system to consist of a series of inductive impedances shunted throughout each element of its length by condensive impedance distributed uniformly. Close approximations to the actual normal operating characteristics of a transmission line can be obtained by considering the total capacity to be "lumped" in certain proportions at definite locations along the line, for example, one-sixth at each end and two-thirds at the center. Calculations based on this assumption give results that are in error to an inappreciable extent in most practical cases. However, for greater accuracy, especially when dealing with extremely long systems, it is preferable to consider the capacity distributed more uniformly in a large number of "lumps" shunted between equal divisions of the total series impedance.

The present issue contains an article by Dr. A. E. Kennelly and Mr. H. Tabossi in which an account is given of the construction and test of three 500-mile artificial transmission lines, each represented by ten series impedances shunted by the equivalent number of capacity circuits. The tests made on the lines connected either as a 500-mile three-phase transmission system or a 1500-mile single-phase system agreed satisfactorily with calculations based on the hyperbolic theory of artificial lines, thereby confirming this theory. By means of the oscillograph such an artificial transmission line can be used for investigating and studying not only the normal operating characteristics but also the various transient and other phenomena in connection with switching, sudden changes of load, etc. However, the investigations cannot extend into the range of over-voltage, corona and similar phenomena, which are of prime importance in long-distance transmission problems. For this purpose tests must be made on actual transmission lines or

on short lengths of lines constructed to true service dimensions. By combining the test data obtainable on the long-distance artificial line with the test data obtainable on a short-length line built to practical dimensions one can predetermine the performance of any actual long-distance line under all conceivable conditions.

THE RETIREMENT OF A GREAT LEADER.

The development of modern industry in America is inseparably associated with the names of its great captains. Personality to-day is one of the greatest assets of our complex industry, and upon the prophetic insight, courage and exalted common sense of its leaders material progress largely depends under present industrial conditions. When such a leader, after three decades of conspicuous service in the foremost rank of one of the most significant movements of the age, retires from the heat and burdens of the firing line to the serene atmosphere of unofficial life those for whom he has been a torch-bearer may well pause and salute him with mingled regret and esteem. In another column of this issue a résumé is given of the work of President Austin C. Dunham, whose retirement on Feb. 13 as the executive head of the Hartford Electric Light Company terminates one of the most fruitful administrative periods in the history of the central-station industry. What the industry owes to this venerable leader is not easily expressed, but it is safe to say that no other central-station administrator has done more to bring new and progressive methods into the field, to try out advanced types of apparatus, to provide the arena for pioneer experiments on a commercial scale, and successfully to market electrical service on the basis of advanced commercial management and prices capable of attracting the patronage of every grade of society. His inventive skill, imagination, receptiveness to change, readiness to forsake the less efficient for the more economical, his willingness to share experience for the benefit of the public, his sound commercial judgment and promptness in accepting heavy responsibilities have been powerful factors in the growth of central-station activity from its cradle days to its present magnificent development. Upon such foundations rests the reputation of Hartford as a historic center of electrical practice second to none in the world, and out of these qualities have come gains to the industry which are both far-reaching and inspiring. Beginning this work at practically fifty years of age, for thirty years Mr. Dunham has been a living rebuke to those who look only to the young for progress; and as he withdraws from the burdens of executive routine to the freedom of private investigation and activity he carries with him not only the honors of a distinguished career but the earnest hope of the industry that he may long be spared to contribute through research and counsel to its enduring and advancing welfare.

SELECTIVE EMISSIVITY OF ELECTRICAL CONDUCTORS.

When one compares the specific output of about two-thirds of a spherical candle per watt obtained from the modern incandescent lamp of the so-called high-efficiency type with the theoretically possible output of 22 candles of white light or 48 candles of monochromatic light per watt absorbed, he appreciates that present-day lamps are very wasteful in transforming electrical power into light. The change from the so-called "3.1-watt" carbon lamp to the "1.25-watt" tungsten lamp has been viewed rightly as a great stride in the advancement of the electrical lighting industry, but it is small in comparison with the possibilities of development. While considerable improvement in the specific output is attributable directly to the substitution of tungsten for carbon on the basis of the more favorable emissivity of the former material, yet much of the increased efficiency can be credited to the higher temperature at which tungsten can be operated as compared with carbon—for at the temperature at which the tungsten lamp is operated the carbon filament would disintegrate with excessive rapidity. Any very considerable increase in the efficiency of incandescent lamps above the value now obtainable with metallic-filament lamps would necessitate the discovery of a material much more capable of withstanding disintegration at high temperatures or more selective in its emission than tungsten. That such a material suitable for lamp filaments may be discovered is an ever-present possibility, but none the less a very remote one. A much more inviting field for investigation lies along the line of gaseous conductors of which selective emission is a predominating characteristic. In fact, it is not too much to expect that the next great development in electric lighting will be brought about by the introduction of lamps using a gas exhibiting marked selective emission within the visible range.

The present issue contains an article by Dr. W. W. Coblentz in which the emission of neon, the recent addition to vapor lamps, is analyzed and compared with that of the helium lamp. The neon lamp shows a specific output of 2.5 candles per watt as compared with about 0.25 candle per watt for helium. The high specific output of the neon lamp is of much interest in itself, but it is of no greater importance than is the fact that it differs so widely from the specific output of the helium lamp. That such a difference exists between these two gases shows that continued search may quickly be rewarded by the discovery of a gas giving considerably greater specific output than neon; for there is no reason to believe that this gas is either unique in emissivity properties or represents the extreme of a series of gases in this respect.

COST OF ENERGY AS A FUNCTION OF LOAD.

The paper by Mr. G. I. Rhodes dealing in general with energy cost, presented at the last meeting of the American Institute of Electrical Engineers, was decidedly illuminating. There have been many studies on the subject of the relation between load and plant efficiency, but few have so thorough a character in their relation to practical station design. Mr. Rhodes starts out along somewhat familiar lines by investigating the nature of the losses which make up the relation between input and output on a station, and shows that in general these are made up in three terms—a constant term, one directly proportional to the output,

and a third of the familiar kind proportional to the square of the output. The interesting part of this program is the analysis of the boiler-room losses in such manner as to show that these same factors apply there as well as in the case of the generator. In Mr. Rhodes' resulting equation the variable terms are defined as proportional to the rating of the apparatus. There are other minor and incidental losses which, in developing the data so that the only variable shall be the load on the prime movers, result in terms, with small coefficients, in the third and fourth powers of the load. The application of this empirical, although carefully developed, series is to show what is the particularly interesting feature in Mr. Rhodes' paper—namely, the change in efficiency and hence in cost at loads above that rated load for the plant upon which the coefficients of his series are based.

In other words, the particular purpose of Mr. Rhodes' paper is the analysis of overload conditions as bearing on costs of operation. His resulting cost curves show in a very striking manner the effect of overload in raising the cost of operation and, what is more important, give a basis for judging the effect of these overload costs on the elements of design of the plant. Of course, one cannot figure such costs with precision without knowing in any given case the real coefficients of the terms depending on the square and higher powers of the load, but the curves given show the effect of these coefficients in raising the cost and the region within which the increase must lie. The upshot of the investigation, so far as the practical bearing goes, is to show that the cheapest method of dealing with seasonal peaks, indeed with peaks in general, is frankly to overload the generators and to stand the resulting losses, assuming that they fall within the limits of possible operation. The figures given tend to show that this method of operation would practically require an overload capacity, say for the peak hours, of twice the normal rating, or possibly a little over. At this point the whole matter is transferred from the theoretical consideration of overloads to the practical question of rating and its effect on operating costs. It is perfectly clear that a plant designed for operation in the manner considered by Mr. Rhodes must cost more per rated kilowatt than if the same generators received a higher numerical rating.

The problem of operating capacity with reference to overloads above the rating, therefore, degenerates into the question of rating. A plant rated for 100 per cent overload on any ordinary basis would show a very remarkable half-load efficiency in terms of its top rating. Of course, the broad fact made prominent by Mr. Rhodes is that efficient operation demands loading the plant to its extreme carrying capacity at peaks, but the numerical values of the overload are wholly a matter of the conventions with which one starts regarding rating. In the early days of the electrical industry machines were rated on a very conservative basis and would stand nominally prodigious overloads. For example, in one case a 100-light machine taken in part payment for a 150-light machine was subsequently resold, after repainting and being supplied with a new commutator, as a 200-light machine and operated satisfactorily on that load. To-day the tendency is, for commercial or other reasons, to work toward higher ratings, even using the maximum output for an hour or two as the figure by which the machine should be judged. So long as the idiosyncrasies of rating adopted are perfectly understood by everybody, it makes no particular difference whether one theory or another is adopted. The danger comes in ignorance of the conventions. From the ordinary point of view the rational rating is that of maximum efficiency of the unit. When the rating is fixed on this basis it is perfectly clear that change of the load in either direction will lead to lessened efficiency, and if the possible overload is clearly defined no misunderstandings can take place. The tendency with improved design has been to push this rating of maximum efficiency further along the load curve than used to be the case, a fact which must be taken into account in any consideration of this matter.

However one rates his apparatus, he can drive through the peaks that are necessarily met in station operation to good advantage by forcing the output, whether by added load on the generators, by sacrificing efficiency of output in the prime movers, or by pushing his boilers to the utmost by forced draft or other expedients. If a plant unit can carry successfully an abnormal peak load at somewhat reduced efficiency, the economic result of the procedure is generally good, as Mr. Rhodes has shown, and the method of analysis which he has adopted is one well suited to figuring out the conditions of maximum economy in any given plant. The main thing from the standpoint of economy is to keep up the efficiency all along the line. Generators have already reached a point that leaves small margin for improvement. Boilers and furnaces, on the other hand, are capable of considerable economic improvement, as the recently published results on the big Detroit boilers very plainly show. The thermodynamic losses in the ordinary plant are still much heavier than they should be. They ought to be cut down, and are going to be cut down, for that matter, in the course of the next few years. Improvement will mean a reduction of cost at all loads, and just what overload it will pay to carry for extreme cases will depend in no small measure on the changes of efficiency which may be accomplished in the various parts of the system. Mr. Rhodes has at least done an exceedingly good thing in marking out the line of attack on station economics which is based on the judicious use of extreme output.

In closing this comment we would venture to suggest that when papers of this kind, somewhat intricate and involving the study of numerous curves and equations, are brought before the Institute particular care ought to be taken to have advance copies in the hands of those competent to discuss the matter at an early date, so that the combined experience of the Institute may be brought to bear on the problem in hand. And the experience of the other evening would also indicate the wisdom of limiting oral discussion to very brief periods so as to obtain the point of view of as large a number of trained engineers as possible, leaving exhaustive consideration of details to written discussion submitted later.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS AFFAIRS.

At the monthly meeting of the Board of Directors of the American Institute on Feb. 9, 114 associate members were elected and the following associates transferred to full membership: Messrs. Samuel Insull, W. E. Holland, A. M. Allen, C. W. Pen Dell, A. L. Mudge and W. C. Bauer. Sixty-six names were added to the list of enrolled students, which brings the total number to about 1000. A resolution was adopted approving a joint meeting of the Institute and the Illuminating Engineering Society. The organization of branches at the University of California, Ohio Northern University and University of Virginia was authorized.

MEMORIAL TO LORD KELVIN.

The president of the Institution of Civil Engineers of Great Britain, in a letter to the president of the Institute, invited contributions from members of the Institute toward erecting in Westminster Abbey a memorial window to the late Lord Kelvin, and asked that a committee consisting of the president of the Institute, the secretary and two members of the board of directors be appointed to co-operate with the Institution of Civil Engineers to this end. The invitation of the Institution of Civil Engineers was most cordially received, and the president was instructed to appoint the committee requested and to co-operate in every possible way in paying respect and honor to the memory of the great British scientist, who at the time of his death was an honorary member of the American Institute of Electrical Engineers. In addition to the president and secretary, Vice-president Charles W. Stone and Manager Walter S. Rugg were appointed members of this committee. This committee, on the suggestion of Mr. Calvin W. Rice, secretary of the American Society of Mechanical Engineers, was authorized to confer with the corresponding committees to be appointed by the other engineering societies in America.

PANAMA VISIT.

Members returning from the Institute convention at Panama, through Prof. George F. Sever, officially designated by the board as the presiding officer of the convention, reported a most successful trip and recommended that the meeting be officially designated a convention in view of its great success and the numerous contacts with other societies and bodies of an international character that had taken place. This recommendation was accepted, and it was authorized to put into the permanent records of the Institute, in the *Transactions*, a complete report of the activities on the trip and the courtesies and hospitalities received from officers of the United States government, the Republic of Panama and other bodies there. A resolution from the convention recommending that at the time of the International Electrical Congress in San Francisco in 1915 a convention of the Institute be held in San Francisco, and that the Eastern members proceed to this convention by means of a chartered steamer through the Panama Canal, was received by the board and referred to the committee on meetings and papers. The particular thanks of the board were voted to Chairman Severn D. Sprong and his committee, consisting of Messrs. A. W. Berresford, H. J. Douds, F. L. Hutchinson, P. Junkersfeld, H. A. Lardner, W. S. Rugg, D. B. Rushmore, Edward Schildhauer, A. M. Schoen, C. E. Waddell and A. J. Wurts, who organized the trip and arranged for the transportation and other details, and to Prof. George F. Sever, who, as official representative of the Institute, was the head of the party in Panama.

NEW GRADE OF MEMBERSHIP.

The president was authorized to call the attention of the membership to the fact that the amendments to the constitution providing for a new grade of membership had been fully published in the February *Proceedings* with comments and explanations. He also recommended that the columns of the *Proceedings* be opened to letters and discussions from members on subjects of Institute interest, so that the monthly publication might be a forum where any member of the Institute could get publicity for views and issues that were of interest to the Institute generally. The board welcomed this suggestion and passed a resolution recognizing the propriety of permitting, to a limited extent and under the supervision of the editing committee, the use of the columns of Part I of the *Proceedings* by members of the Institute for the expression of their views upon topics of current Institute interest.

PANAMA INTERNATIONAL ELECTRICAL ENGINEERS CONGRESS.

The report of the special conference committee on the General Engineering Congress at San Francisco in 1915, of which Mr. H. A. Lardner is chairman and Messrs. S. J. Lisberger and George R. Murphy are members, was read in full to the board, and the memorial adopted by the recent conference of the National Engineering Societies at San Francisco was presented. The president received power to act upon this memorial in regard to its relation to the committee on organization of the International Electrical Congress in 1915 and was requested to recommend certain further action to the board at its next meeting.

EDISON CELEBRATES HIS SIXTY-FIFTH BIRTHDAY.

On the invitation of Mrs. Edison a party of fifty sat down to dinner on the evening of Feb. 10 (Saturday) at Glenmont, Orange, N. J., to celebrate the sixty-fifth birthday on Sunday of her husband, himself a guest for the evening. The function developed around the fact that the veteran associates of the great pioneer who had been with him at old 65 Fifth Avenue, or prior to those early days in electric lighting, wished to offer him a special mark of love and esteem and had invited him to be their guest. But Mrs. Edison had the happier thought and thus blended the two ideas in one delightful and memorable event. The banquet was given in the big music-room of the Edison home on Orange Mountain, and the party sat at a huge table within whose hollow square was a literal "flower town," with lawns, shrubs, lakes and a real Edison cement house at the center. On the inner edge of the table were set sixty-five low posts with frosted incandescent lamps. Mr. Edison occupied a solid, comfortable chair made out of his own cement, given by his co-workers in that incidental branch of industry. The menu bore an incandescent lamp, every ray of which was named with an Edison invention. The souvenirs were a latest portrait of the "Old Man" and a bronze plaque, dated 1847-1912, showing the two laboratories, at Menlo Park and at Orange, and the two inventions—the stock ticker and the storage battery—between whose temporal confines lies all the other monumental work. The dinner was accompanied by vocal and instrumental music on the latest Edison phonograph.

At the close of the dinner, at which Mr. R. T. Lozier officiated as master of ceremonies, Mr. E. H. Johnson in the name of the old timers presented Mr. Edison with a superb silver loving cup, standing about 2 ft. high and engraved with "65" and the names of the donors. This was accompanied by an engrossed address on vellum in the hands of Mr. T. C. Martin for signature. The cup was duly christened. Mr. Samuel Insull, sitting on the left of his old chief, responded for him felicitously, and characterized him as "the greatest living private citizen of our race." Mr. H. M. Byllesby, who did the early field work in introducing the Edison lighting system, responded gracefully on behalf of Mrs. Edison and the family.

After dinner the party adjourned to the drawing-room for a reception, which was attended in addition by a large number of Mr. Edison's other friends and associates; and then there was given a notable motion-picture exhibit, including some of the latest educational work that Mr. Edison has been doing in this direction. The reception came to a close about 11:30 p. m. Among those also present in the "65" class were Messrs. Frank J. Sprague, W. H. Meadowcroft, John W. Lieb, Jr., C. S. Bradley, W. S. Andrews, S. D. Mott, M. F. Moore, Arthur Williams, R. M. Searle, John Ott, Fred Ott, W. H. Hammer, Charles Wirt, S. S. Wheeler, C. L. Clark, C. A. Benton, J. P. Ord, E. J. Berggren and J. W. Howell. The party also included Miss Madeleine Edison and her brothers Charles and Theodore, and among others Messrs. C. A. Coffin, T. E. Murray, F. L. Dyer, Fremont Wilson, I. C. Walker, J. W. Aylesworth, P. Weber, A. O. Tate, W. H. Brock, W. G. Bee, M. R. Hutchison, H. Miller, Ralph Beach, W. S. Mallory, J. G. White, Joseph Insull, W. W. Freeman, W. E. Freeman and E. W. Hammer. A great number of cable messages and telegrams were received, including dispatches from Messrs. F. R. Upton, C. L. Edgar, R. R. Bowker and from "Sig" Bergmann, who has just been made a privy councilor of the German Empire.

RECENT EXPERIMENTS IN "WIRED WIRELESS" TELEGRAPHY.

Some interesting additional data have been obtained from the office of the Signal Corps, War Department, on experiments in continuation of those that were made on Jan. 21 with the "wired wireless" system invented by Major George O. Squier, U. S. A., which was described on page 223 of our issue dated July 22, 1911. Through the courtesy of Mr. M. M. Davis, chief engineer of the Postal Telegraph-Cable Company, tests were made by Major Squier on Sunday, Feb. 11, on a line extending from the Signal Corps laboratory at the Bureau of Standards in Washington to 253 Broadway, New York City, the general office of the Postal Company. Both a metallic circuit and a grounded circuit were used in the tests of Feb. 11, the line being a mixed commercial line consisting of No. 9 B. & S copper wire on poles, subterranean cable line in Baltimore, and subterranean and submarine cable lines through Philadelphia and entering New York City. The total resistance of metallic circuit was about 3200 ohms. No change whatever was made in this circuit as used in regular commercial telegraph service.

The principal object of last Sunday's experiments was to determine important data as to the range of frequencies to be employed in reaching the longer distances by the "wired wireless" system and also the order of magnitude of the energy necessary and sufficient for such purposes. The measurements taken at the transmitting end of this line extended over a range from 34,000 cycles per second down to about 22,000 cycles.

The prime importance of tuning such a line to resonance and the comparative ease with which this can be done with the commercial wireless apparatus were clearly demonstrated. This tuning of the line, whether a metallic circuit or a grounded circuit, required only a few minutes.

A number of experiments were conducted to determine the most suitable form of coupling between the generator circuit and the line circuit, the generator being directly connected to the line through the tuning elements as well as by the more usual manner of inductive connection. It was found that inductive coupling to the local generator circuit is far more efficient and convenient and, further, enables a number of lines to be operated from one generator with great ease.

At the receiving end the ordinary wireless-telegraph receiving equipment was employed, using the "audion" detector with high-resistance telephone receivers, and the elements were tuned to the particular frequency being transmitted. It was found desirable to tune the line both at the transmitting and at the receiving end and to adjust the coupling to the optimum value in both cases.

The prime importance of operating these circuits at resonance was strikingly observed, since when the generator terminals were directly connected to the line without the tuning elements only the smallest readable current was obtained, whereas with proper tuning this current could be multiplied some hundredfold. With a transmitting current of 260 milliamperes at 22,000 cycles per second, signals just audible were heard in New York, thus indicating the lower limit of transmitting power with the particular line and frequency in use.

In the previous experiment with a line to Baltimore, about 48 miles long, frequencies up to 44,000 were used with a transmitting current of only 180 milliamperes, giving very loud and clear signals far above what would be necessary in traffic.

A large number of physical measurements were made on Feb. 11 at the transmitting end of the New York line over a comparatively wide range of frequencies, and the results obtained conform to what was expected from previous work on other lines. It appears evident to War Department experts that the range of frequencies for "wired wireless" will extend from about 10,000 per second, as a lower limit, up to about 100,000, which is considerably above the lowest frequency now employed in long-distance radio-communication.

Just as in pure radio-telegraphic work the longer wave-lengths are used for the greater distances, so in "wired wireless" the longer wave-lengths corresponding to the lower frequencies will be employed, it is believed, for the long-distance circuits, reserving the shorter wave-lengths and lower power for the shorter circuits; thus the range from 10,000 to 25,000 cycles per second will be used on the long circuits and the upper region between 25,000 and 100,000 cycles will be used on the shorter circuits.

The proposed high-powered navy station in Washington, which will be in operation next July, uses a power of 100 kw and has a range of 3000 miles with a wave-length of 4000 m, which corresponds to 75,000 cycles per second.

It is clear from the above figures that the great increase in efficiency obtained by directing electric waves along wires to their destination, as shown by the amount of power required to send audible signals over such a circuit as described above, is beyond question. The plant necessary to transmit messages from Washington to New York by pure radio-communication would be of about 5-kw rating. In addition to the advantage obtained by directing waves to their destination, perhaps the greatest advantage is the fundamental one of freedom from interference between messages, which is ever present in wireless communication. The wire system guides the waves to their destination with greater efficiency and practically confines the electromagnetic disturbances between the conductors and prevents the waves from spreading outward in every direction in space, as is the case in radio-communication.

In the opinion of experts in Washington pure radio-telegraphy, which is now an infant art, scarcely more than twelve years old, has no competitor in the marine field, that is, between ship and ship and between ship and shore. On the other hand, on land, especially in congested districts, even if the process of selective tuning should be developed so as to select messages by pure radio methods, radio-communication would still be totally inadequate, in the absence of wires, to handle the traffic of a large city.

The so-called "wired wireless" fills in the gap between the pure radio art and the wire art and indicates lines of development wherein one can apply the principles of wire-

less engineering to wire circuits and create additional telegraphic and telephonic channels for commercial use without the extra cost of maintenance over the use of such circuits for other electrical purposes.

Court Decides a Central Station Is a Manufactory.

The Kentucky Court of Appeals has reversed the decision of a lower court in a case where a tax assessor sought to tax the Kentucky Electric Company of Louisville upon its plant, on the ground that it was a public-service corporation, and regardless of an ordinance granting immunity for a period of five years from taxation for any new manufacturing enterprise in Louisville. The decision of the upper court was that the Kentucky Electric Company is a manufacturing concern in addition to being a public utility, and that taxes could not be collected by the city on the generating plant, although the distributing properties, wires, poles, etc., through the city were subject to taxation. The apparatus for distribution of electricity may not be listed as immune from taxation inasmuch as it is not necessary to the manufacture of electricity and the ordinance deals specifically with the production and sale of manufactured commodities, said the court.

Attempt of Hydroelectric Company to Enter Rhode Island.

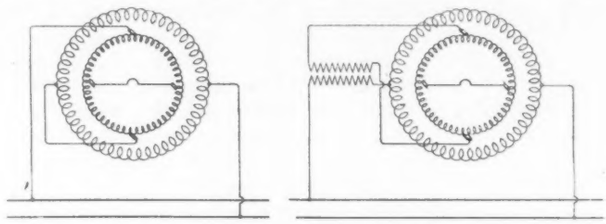
In a recent interview Superintendent E. J. Richards, of the Connecticut River Transmission Company, the headquarters of which are at Fitchburg, Mass., announced that the Chase-Harriman interests are planning to extend their service into the Providence (R. I.) district in connection with the forthcoming completion of new generating plants in the Deerfield Valley, under the corporate organization of the New England Power Company. An application for a franchise has been filed with the Providence City Council, the New England company having announced its intention to confine its activities to the marketing of electrical energy for motor service. At present the Narragansett Electric Lighting Company has the exclusive right to sell electrical energy in Providence. Superintendent Richards states that it is the intention of the company to build a high-tension transmission line from Worcester to Providence, operating the Deerfield Valley plants near Shelburne Falls in parallel with the present hydroelectric installations at Vernon, Vt., and Clinton, Mass. A branch 66,000-volt transmission line is under consideration for the North Adams-Springfield district.

COMPENSATED REPULSION MOTOR PATENTS.

In the accompanying illustration is shown the well-known compensated repulsion motor, with conductive and inductive connections between the stationary and revolving members, which formed the subject of a United States patent issued to Mr. Marius C. A. Latour, of France, on Jan. 30, 1911. The application for this patent was filed on Jan. 19, 1904, and one for a French patent on the same invention on Jan. 21, 1903. Our issue dated July 21, 1910, contained an account of interference proceedings between the application for this patent and that for a patent on the same invention made independently by Messrs. G. Winter and F. Eichberg, who had applied for a German patent on Jan. 24, 1903. The priority of invention was awarded to Latour by the examiner-in-chief, and this action was upheld upon appeal by the Commissioner of Patents. A peculiarity of the case was the common ownership of the conflicting American applications and the appearance in court of the same attorney for the appellee and appellant.

A characteristic feature of the motor covered by the Latour patent is that it operates with perfect commutation at synchronous speed; moreover, the inductance of the rotor disappears at this speed and becomes negative above synchronism. The just claim of the patent is as follows:

"In a single-phase machine a primary member adapted for connection to a single-phase source, a secondary member having a distributed winding connected at intervals to the segments of a many-part commutator, a set of brushes short-circuiting the secondary winding on a line substantially parallel to the line of primary magnetization, and another set of brushes, displaced substantially 90 electrical degrees from the first set of brushes, connected in series with the primary winding of the machine."



Latcur Compensated Repulsion Motor.

On Feb. 6 there were issued to Messrs. Winter and Eichberg two United States patents on applications filed June 11, 1902, for a commutator type of alternating-current machine resembling somewhat the compensated repulsion motor. The first claims of these two patents are as follows:

"In combination, an alternating-current machine supplied with a commutator and brushes, windings on both members of said machine adapted to magnetize said machine in a fixed direction, means for supplying to said windings voltages of relatively varying magnitudes, and means for magnetizing said machine in a second direction at an angle to the first direction."

"An alternating-current motor of the commutator type, having brushes co-operating to form for each pair of primary poles, first, a path along the line of the primary field for the currents induced in the armature, and, second, means for feeding a magnetizing current from outside for generating the torque-producing field of the motor."

THE ELECTRIC VEHICLE AT BOSTON.

At the regular weekly meeting of the Electric Vehicle Club of Boston on Feb. 7 it was announced that a banquet would be given to the master teamsters of Boston at the end of the present month, in order to facilitate a closer acquaintance and to bring home the possibilities and results of electric-truck service in an effective way. A brief discussion of advertising also took place, in which the point was made that all dealers in electric vehicles ought to join forces in the Boston campaign for at least three months. A systematic plan of advertising is being prepared, showing exactly what is to be done with different Boston dailies in the immediate future. The rest of the discussion related to a bill now before the Legislature which is designed to limit the weight of a motor truck and its load to a maximum of 6 tons and to restrict the load on the street to 800 lb. per inch of tire width. President Baker announced that this would make the use of all the large brewing and coal trucks now in service illegal and would seriously handicap the development of motor transportation. It was stated that Colonel Sohier, of the Massachusetts Highway Commission, desired a speed limit of not over 6 miles per hour for vehicles with steel tires, some of these being of the electric type with motor-driven tractors on the front and

steel rear wheels. Particular embarrassment is occasioned by the tendency of tire builders to design tires half round at the bearing surface, which greatly increases the pressure per square inch or per inch of width in contact with the roadway. Arrangements were announced by which a determined stand against the bill would be made before the legislative committee in charge. The meeting closed with some suggestions by Mr. W. H. Francis, purchasing agent of the Boston Edison company, regarding electric-vehicle requirements. Mr. Francis emphasized the disadvantages of carrying battery boxes too close to the ground and asked for a minimum of 12 in. to 15 in. to enable the vehicles to work under adverse conditions of snow and mud. He also criticised the exposure of chains and the design of steering gears in certain cases and said that improvements along these lines ought to be forthcoming regardless of any tendency of manufacturers to "standardize their products."

MOTOR-TRUCK HEARING AT BOSTON.

Owners of electric and gasoline motor trucks appeared in force at Boston on Monday, Feb. 12, to protest against the passage of a law limiting the speed and weight of commercial power-driven vehicles operated on the public highways. Mr. Day Baker, president of the Electric Vehicle Club of Boston, had general charge of the hearing, which was held by the legislative sub-committee on roads and bridges. The proposed statute as drawn by the Massachusetts Highway Commission limits the speed of motor vehicles weighing 4 tons or less to 15 miles per hour, and vehicles in excess of 6 tons using iron tires are limited to 6 miles per hour, 12 miles per hour being allowed with rubber tires. Another feature of the bill is a provision limiting the weight of vehicles to 800 lb. per inch width of tire in contact with the ground. A large amount of testimony was introduced by teaming and truck experts against the bill, and it was urged that a general investigation of the subject along thoroughly scientific lines precede any legislation.

Among the data of interest to users and designers of electric and gasoline trucks were those given in the accompanying table. The loads on tires are figured on the base width, whereas tires are now mainly of hemispherical shape when new.

WEIGHTS OF TYPICAL ELECTRIC VEHICLES, LOADS AND TIRE SIZES.

Rated load capacity in tons	2	3.5	5	6
Weight of vehicle in pounds	6,520	9,115	10,500	12,000
Weight of vehicle and load	10,520	16,115	20,500	24,000
Tire load per inch of width, pound	570	602	603	600
Rated speed in miles per hour	9	8	7	6

Other figures presented gave the following weights per inch of tire width: Electric truck, with two steel rear wheels, weight on rear wheel 1889 lb. per inch of width; electric truck, four motors, rubber-tired wheels, 1160 lb. per inch width of tire, load on truck 11,460 lb., total weight 26,160 lb.; weight on 1 in. of rear tire, assuming entire 5-in. width is in contact with earth, 696 lb. (Only about 60 per cent of the tire contact rim is on the ground.) The weight per inch of tire for a gasoline truck weighing loaded 23,500 lb. was 740 lb.; for a 14,000-lb. loaded horse-drawn wagon without horses the weight per inch of tire was 1400 lb., and the weight per inch with an electric truck weighing loaded 17,400 lb. and light 11,400 lb. was 480 lb. per inch of tire. The unanimous opinion of the truck users was that the alleged damage to roadways caused by motor trucks moving at the moderate speeds customary was a thing to be proved, and it was strongly urged that no legislation be enacted which would tend to hold back the progress of these advanced and efficient methods of transportation.

THE ELECTRICAL JOBBERS' MEETING AT CLEVELAND.

The quarterly meeting of the Electrical Supply Jobbers' Association was held on Feb. 13, 14 and 15 at the Hollenden Hotel, in Cleveland, Ohio. The Electrical League of Cleveland acting as host had prepared a comprehensive program of entertainment in which jobbers and manufacturers participated alike. By noon of the second day of the convention the registration at the headquarters of the league had reached a total of 526.

On Tuesday the jobbers held their divisional meetings, assembling according to the geographical location of members, and on Wednesday and Thursday they devoted their time to meetings of the entire body for the discussion of trade questions common to all members.

On Wednesday morning Mr. W. H. Merrill, of the Underwriters' Laboratories of Chicago, addressed the meeting and made a plea for higher standards for electrical material. His talk was somewhat along the lines of addresses heretofore made by him to this association. Interesting figures were given comparing fire hazards in the United States with those in European countries. In drawing these comparisons he showed that the losses in the United States were in some cases ten times as great as those incurred elsewhere.

Another paper was that by Mr. E. R. Gilmore, assistant treasurer of the Western Electric Company, whose subject was "Credits." This paper was well received, as the subject was one of intense interest to the Jobbers' Association, the author's remarks being thoroughly appreciated by his audience, whose problems are mercantile rather than technical.

Mr. H. T. Wreaks, of New York, discussed the new 1911 code specifications for rubber-covered wire. He drew a brief comparison between these and previous code wire specifications and stated that the physical and chemical tests in the new specifications are additions to any previous code specifications. He explained how the electrical and physical tests are based on a factor of safety of from 10-to-1 to 3-to-1 on the dielectric tests according to whether the wire is to be used for 125-volt or 500-volt service; of about 300-to-1 on insulation resistance tests, and of about 4-to-1 to 2-to-1 on flexibility and physical tests, according to age of wire. Mr. Wreaks explained further the relative importance of these tests, the necessity of their being applied as a whole in order to allow for proper judgment, and how the specifications called for the physical and electrical requirements to be met up to at least one year after date of manufacture. He showed how the procedure under which the inspection and label service of the Underwriters' Laboratories is being operated covers a field inspection and follow-up system designed to insure that the requirements are properly met. The function of the chemical test is to insure at least 20 per cent of rubber in any compound meeting the requirements.

The attention of the jobbers was called to the fact that these specifications and this procedure represent the best thought of the wire manufacturers and the inspection departments throughout the country, both insurance and municipal, as to the means of obtaining good wire for house service. In order to obtain this result as quickly as possible, it is important for the jobbers to co-operate with the other interests mentioned and do their share to help make the new specification inspection service of greatest value. This they can do, in a large measure, by keeping the Underwriters' Laboratories posted as to any wire offered

at prices so low as to raise a doubt that the material passed the original test at factory and conforms to tests called for in the field.

On Thursday morning the manufacturers of incandescent lamps through Mr. Adam D. Page, of the General Electric Company, outlined the methods by which it is proposed to handle the incandescent-lamp business under the plans that have been under discussion and development ever since the filing of the decree in the government suit. This meeting was held in executive session and no data for a report of the session are available, but it is understood that a public announcement by the lamp manufacturers setting forth the methods under which they will market their product will be made shortly.

On Wednesday afternoon Mr. N. C. Cotabish, of the National Carbon Company, chairman of the "sightseeing committee," conducted a party through the plant of the National Carbon Company, the guests being confined to members of the jobbers' association. A similar trip was made on Thursday afternoon through the laboratories and the tantalum and tungsten works of the National Electric Lamp Association.

The most important entertainment of the convention was given on Wednesday evening at Gray's Armory under the direction of the entertainment committee of the Electrical League. This affair was opened by a brief address of welcome by Mr. David Aitken, president of the league, and a response by Judge T. M. Debevoise on behalf of the Jobbers' Association. Following these preliminaries the evening was brought into full swing by the opening of the "Grand Colonial Minstrels," with Mr. H. H. Cudmore filling to the full the position of interlocutor. This part of the program was presented by the National Electrical Lamp Association, within whose organization, as is well known, there is a remarkable variety of histrionic talent. Other features of the program were athletic performances and vaudeville numbers especially arranged for the occasion. The audience was seated at small tables distributed about the hall, and displayed conspicuously before it was an electric sign bearing this legend:

The man who uses hook and line pulls in his single fish,
But who join hands and pull a seine get all that men could wish,
And each man's share is greater far, in size as well as weight.
The secret of success is this—Co-operate.

At the conclusion of the festivities it was generally agreed that the entertainment committee had done a remarkably good job. Nearly all the performers were amateurs and were members of the Electrical League of Cleveland. Mr. H. H. Cudmore, chairman of the committee, had worked hard and continuously, as he always does on such occasions. His collaborators on the committee were Messrs. J. G. Pomeroy, W. C. Wing, David Aitken, H. C. Rice, R. G. Pate and T. P. Cagwin.

On Tuesday evening a "rejuvenation" of the Sons of Jove was held at the Elks' Hall, when sixty-one candidates were admitted to the order. Over 250 Jovians were present to witness the ceremony. The Pittsburgh initiation team did much of the floor work and initiation on this occasion. This team is famous throughout the country for the perfection of its work in this respect. It is composed of the following: Messrs. Henry Harris, Jupiter; M. F. Knapp, Pluto; R. C. Owen, Neptune; Saul Levine, Vulcan; W. D. Shaler, Mars; J. Edward Erickson, Mercury.

The enthusiasm and good fellowship—of the substantial and salutary kind—which of late have marked gatherings like that just concluded at Cleveland are good for the electrical industry. The slogan "All together, all the time, for everything electrical" can be made a great asset of the craft. It is evident that a constantly increasing number of the serious-minded men in the business are taking seriously the spirit and the works of those who preach "Jovianism" and the philosophy of co-operative effort which it seeks to embody. The Electrical League of Cleveland has been in existence for about three years. It is a direct descendant from the early enterprising and progressive endeavors of Mr. J. Robert Crouse, of the National Electric Lamp Association, who is first vice-president of the league. The other officers are: President, Mr. D. Aitken, the George Worthington Company; second vice-president, Mr. N. C. Cotabish, National Carbon Company; third vice-president, Mr. P. Yensen, Cleveland Telephone Company; fourth vice-president, Mr. L. Griesser, Cleveland Electrical Supply Company; secretary and treasurer, Mr. T. P. Cagwin, Cleveland Telephone Company.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION MANIFESTS A CONCILIATORY ATTITUDE.

Apparently the National Independent Telephone Association passed a crisis at its fifteenth annual convention held in Chicago on Feb. 7, 8 and 9. For the last year or two some of the directors of the company have been conducting negotiations with the American Telephone & Telegraph Company and J. P. Morgan & Company having for their object a degree of co-operation between the two great telephone systems of the country—that is, the associated Bell companies on the one hand and the Independent interests on the other. This policy was criticised sharply at the recent convention by the more belligerent Independents, who declared that some of the members of the retiring board of directors had not represented the Independent telephone movement faithfully and that these men should not aspire to re-election. Politics predominated in the convention, there being comparatively little attention paid to technical matters, and when the smoke of battle cleared away the men complained of had been re-elected as directors, so that the outcome of the convention may be considered, perhaps, a victory for the negotiators rather than for the "last-ditch" men. The convention was held in the Hotel Sherman, where there was also a collection of interesting exhibits. The attendance was estimated at 500.

The feature of the first session was the delivery of the annual presidential address by Mr. Manford Savage, of Champaign, Ill., which was of particular interest owing to the existing crisis in the relation of the Bell and Independent telephone interests. Mr. Savage took for his theme "The Outlook." He said that a reasonable national control of public utilities by law is very important to Independent telephone men, but there should be regulation and not destruction. Referring to the suggested government ownership of telegraphs, he said that from one point of view such a plan would be of much importance to the Independent interests, and the project deserves consideration, although there are two sides to the question. It may be necessary for the Independents to discard some of their old ideas. The men who are providing telephone competition should not fear government control, investigation or wise regulation. They should favor the enactment of sound public-utility laws in each state. Leading Bell officials are now advocating the same thing, reversing in many cases their previous policy on this question. If the Independents are wise in meeting new conditions of the present hour the future of their industry looks bright.

Speaking more particularly of association affairs, the president said that among other things the year had brought a recognition to the Independents never before reached, although the association has been financed but slenderly and has fallen short of what it was hoped might be accomplished during the year. The recognition spoken of was the joint meeting by invitation of the United States government authorities of a committee representing the association and delegates from the Interstate Commerce Com-

mission. This body is charged by Congress with the duty of regulating interstate telephone rates, and for the first time the National Independent Telephone Association was recognized in its deliberations. The conference resulted in modifying the system of accounting for telephone systems which the commission had in view before the meeting. Another important feature of the year has been the fact that the American Telephone & Telegraph Company has abandoned its policy of cutting off independent toll-line connections by the purchase of plants. Mr. Savage suggested that the association should be composed only of men who have faith in one another. Loyalty is not to be measured by the amount of vituperation that can be heaped on a competitor. Charity may be used to advantage in the Independent telephone business. Few leaders in the business control the stock of the companies they represent. The speaker pleaded for a non-partisan, independent association, for real co-operation and for frank round-table discussion of present-day issues.

Mr. J. C. Crowley, of Superior, Wis., who spoke on "Experiences Under Commission Control," praised the work of the Wisconsin Railroad Commission in regulating public utilities in that State and said that few of the public-service corporations would be willing to return to the old condition of affairs. The law has proved to be more than a success. As to the physical connection of telephone properties, there is a law to that effect in Wisconsin, but the Bell people seem to think that it is unconstitutional. Representatives of the Bell company advocated the passage of this law, but do not appear to accept it in sincerity.

Mr. S. E. Ward, of Mansfield, Ohio, gave an interesting review of the telephone situation in Ohio. In analyzing the situation the principle seemed to develop that two telephone companies cannot continue to operate permanently in the same community and both make money. It seemed to be good judgment to stop a useless waste, and negotiations followed to clear up the situation throughout the State. In some cases the Independents absorbed the Bell properties; in others the Bell absorbed the Independent interests. In still other cases new companies were formed to take over both properties. The idea was to continue all telephone investors as investors and to continue to receive their support. This policy has been pursued. Practically every Independent company in Ohio has had negotiations with the Bell company. At the present time there are practically no communities where there is telephone competition. The solution arrived at seemed to be the only one that could be adopted by thoughtful men. There is nothing to be ashamed of in the Ohio telephone situation, Mr. Ward concluded, and no Ohio telephone man has anything to conceal.

At the session on the morning of Feb. 7 President Savage appointed a committee on nominations, Mr. E. B. Fisher, of Grand Rapids, Mich., being chairman. This committee made its report on the morning of the next day, and this report was sharply criticised. The committee, following the procedure indicated in the by-laws, presented a list of thirty-five names, from which seventeen directors were to be elected by ballot. Mr. B. G. Hubbell, of Buffalo, suggested that the men on the ticket who are not really Independent telephone men should withdraw. After a heated discussion, during which frequently several delegates were on their feet trying to speak at once, a motion requesting the suspects to withdraw from the list of nominees was declared lost, and finally the report was referred back to the committee for further action. Later the nominating committee reported that the name of Charles H. Hood, of Aurora, Ill., had been added to the thirty-five names previously presented and that no other change had been made in the list. The electricity in the atmosphere of the convention seemed to have been dissipated by this time, and the report of the committee was then adopted without further debate. On the morning of Feb. 9 the judges of election reported that the following directors had been elected: Messrs. E. B. Fisher, Michigan; N. G. Hunter, Indiana; H. D. Critchfield, Chicago; S. E. Ward, Ohio; Manford Savage, Illinois; H. B. McMeal, Chicago; W. J. Thomas, Kentucky, E. D. Schade, Pennsylvania; J. C. Casler, Texas; B. G. Hubbell, New York; A. A. Godard, Kansas; F. H. Woods, Nebraska; L. D. Kellogg, Chicago; G. W. Robinson, Minnesota; Theodore Gary, Missouri; W. C. Handlan, West Virginia; Richard Valentine, Wisconsin.

All of these directors had been indorsed by the "insurgents" except Messrs. Critchfield, Savage, McMeal, Godard, Woods and Gary. The net result, therefore, was that the men criticised retained their places on the board. Messrs. Fisher and Hunter received the highest number of votes, each having 114. The president, vice-presidents, secretary and treasurer of the association will be elected by the board of directors at a meeting to be held on March 4.

So much time was taken by the politics of the association that the technical conference, in charge of Mr. L. E. Hurtz, of Lincoln, Neb., was rather neglected. However, short sessions were held on the afternoon of Feb. 8 and the morning of Feb. 9. Such subjects as the life of dry batteries on local-battery telephone lines, pole preservation, distinguishing party-line calls, one-way or kitchen telephone service, use of automobiles in telephone service and phantom circuits were discussed.

On the evening of Feb. 8 there was a banquet attended by about 400 persons at the Hotel Sherman. This was a good-fellowship gathering, and the dissensions of the day were forgotten. Mr. N. G. Hunter, of Wabash, Ind., acted as toastmaster, and there were speeches by Mr. D. M. Neill, of St. Paul; Mr. C. O. Frisbie, of Chicago; Mr. Manford Savage, of Champaign, Ill., and Mr. H. H. Johnson, of Cleveland. In relation to the competing telephone service in Chicago, Mr. Frisbie made the interesting statement that a long-distance connection with the Independent lines of Indiana by way of South Bend was being built and would probably be in operation in about six weeks. Further, he said that toll lines to connect Chicago with the Independent properties of southwestern Illinois were being rapidly extended.

At the general session of Friday morning, Feb. 9, Mr. A. A. Godard, of Topeka, Kan., made a dispassionate speech on "The Situation." He said that he believed the Bell company has been compelled to recognize the fact that the Independents are here to stay. It has also recognized the great political force of the Independents. However, the Independents in their turn are compelled to recognize the further fact that competitive plants are disappearing. With government and state regulation the necessity of telephone competition is not so great as it was formerly. Mr. Godard said that if an Independent company can make an advantageous contract with a Bell company he does not think the Independent company should be condemned for doing so. The association should devote more attention to technical work and to the subject of government and state regulation of public utilities. In conclusion, Mr. Godard wanted it understood that he does not advocate any subservience to the Bell company. The relation of the two systems must be based on mutual respect and interest.

Mr. Cable, of Ohio, presented the report of the committee on resolutions. This report, which was adopted, favors federal control of interstate telephone toll lines, but is opposed to federal control of local telephone exchanges and local telephone business, even if such business consists in part of toll-line service. The placing of local telephone properties under the supervision of state commissions is favored. It was recommended that uniform public-utility laws be advocated in the various states, and the resolutions also indorsed the president's annual address and the work of that officer during the year. It is signicant that the resolutions contained no denunciation, or even mention, of the Bell telephone system. At preceding conventions a competitive purpose was avowed in unequivocal terms.

RELATION BETWEEN LOAD-FACTOR AND COST OF ENERGY.

In a paper entitled "A Method of Studying Power Costs with Reference to the Load Curve and Overload Economies," read by Mr. George I. Rhodes before the American Institute of Electrical Engineers, in New York on Feb. 9, an analysis was made of the elements affecting the cost of producing energy. It was shown that in the yearly cost certain items depend upon the equipment selected but are independent of the actual load, certain other items vary directly with the load, others with the square of the load, and others perhaps with the cube or fourth power of the load. By expressing these different items and the total annual cost in the form of equations the author showed that under practical operating conditions it is advantageous to select equipment of low rating and operate it at large overload during the peaks, rather than to install more expensive equipment of such a rating as not to be overloaded at any time.

In spite of the low efficiency of operation at overload and the accompanying excess cost per unit output under these conditions, there is actually a reduction in operating costs with a reduction in rating, due to the fact that the saving in no-load losses and interest on investment more than counterbalances the effect of the excess cost of overload losses. Even with a very wide range of poor economy at overload a very material reduction in total cost of energy may be secured by running the plant at enormous overloads during the winter peak loads, the limit being only that of available apparatus.

In order to insure against the possibility of one unit being out of service during the peak load at any time the overload range of the prime movers should be sufficient to cover the additional load per unit occasioned by such failure. In the boiler-room the large number of units always installed makes additional equipment unnecessary. On account of the fact that this extra load range for insurance purposes may never be called upon, the excess operating cost when it is used is of no importance whatever. In the boiler-room it is possible even now to secure greater overloads than called for, even without material reduction in economy. Some gain in energy cost may be made by reducing the boiler equipment, but only about one-half to two-thirds of that obtained by reducing the entire plant.

In summing up his conclusions the author stated that under ordinary city load conditions, where the maximum loads appear only a few times a year, the power plant should be of such size that it will run at the maximum possible overload during these peaks, with sufficient margin for insurance, and that a large sacrifice in overload economy may be allowed without decreasing appreciably the benefits derived.

Discussion.

Mr. H. G. Stott said that the value of the paper depends upon what is meant by "rating." Formerly machines were rated with reference to the load at maximum efficiency, while at present steam turbines are rated at their maximum permissible output. In view of the tremendous margin between these two limits it is almost impossible to determine just what "overload" means. He suggested a return to the former method of rating based on the point of maximum efficiency, with all possible excess loads considered as being within the "overload" range.

Mr. H. L. Smith claimed that in the analysis of statistical data relating to the cost of producing energy it is usually irrational to resort to mathematical expression, and objected to the use of terms showing elements of the cost that vary at a rate greater than the square of the load.

Mr. P. M. Lincoln urged that apparatus should be rated on the basis of the permissible temperature rise rather than upon the point of maximum efficiency or the maximum permissible output.

Mr. C. O. Mailloux remarked that the paper contains merely a simple way of placing before the reader in algebraic terms the interesting facts determined by the author's graphical analysis of practical data. By finding mean factors to represent the mean square of the load, the mean cube of the load, etc., the author has cleverly eliminated all of the higher powers in a very simple manner.

Mr. Farley Osgood said that by means of the plan described by the author one can quickly determine where the avoidable losses occur after making a very small number of simple calculations.

A UTILITIES INDEMNITY EXCHANGE.

To secure at cost the protection ordinarily granted by liability insurance companies, and to go a step further in eliminating technicalities and working toward the interests of the operators themselves in reducing claim payments and maintaining cordial relations between operators, employees and the public, a utilities indemnity exchange has been organized at St. Louis at the suggestion of a number of operators. The manner of operation of this exchange was explained by Mr. L. T. Block in a talk before the Wisconsin Electrical Association at Milwaukee recently. The principle of inter-insurance is not new. It has been employed for somewhat more than twenty years in various lines of business, especially as regards fire-insurance protection, and it has been successfully operated along liability lines by numerous groups of manufacturers. The Utilities Indemnity Exchange is new only in that it is the first organization of public utilities plants along these lines.

A number of well-known central-station men compose the advisory committee of the exchange, which has offices at 503 LaSalle Building, St. Louis. The chairman of the committee is Mr. A. C. Einstein, general manager of the Union Electric Light & Power Company, St. Louis, and president of the Suburban companies of that city. Mr. Hugo Wurdack, treasurer of the exchange, is president of the Light & Development Company of St. Louis, which operates properties at Fort Scott, Kan.; Paris, Tex.; Tahlequah, Okla., and Cape Girardeau and Poplar Bluff, Mo. Other advisory committee members and their properties are Messrs. J. J. Frey, Hillsboro and Collinsville, Ill.; F. J. Postel, Gibson City and Harrisburg, Ill., and F. E. Murray, Louisiana, Mo. Judge Daniel G. Taylor, St. Louis, is counsel for the exchange.

Operators who become members pay into the exchange the sums they would otherwise pay as premiums to liability insurance companies. Thirty per cent of these sums are then in turn payable to the Utilities Service Company, a corporation organized to manage the exchange, to cover management expenses. The remaining 70 per cent is placed with trust companies under depositary agreements for the payment of losses and loss expenses.

Out of the 30 per cent payable for management expenses, all of the expenses of the exchange are borne, including the maintenance of an adjusting department which handles the investigation of accidents and the adjustment of losses and an inspection department for improving conditions at the plants of subscribers, to reduce losses and to promote economy and efficiency of operation. A service of value to operators of small plants is also rendered free in the form of consultations or correspondence with a firm of consulting mechanical and electrical engineers. Operators who may want to make inquiry regarding fuel economies, the purchase of new equipment and similar matters can thus secure without cost information which ordinarily involves considerable expense and trouble.

By the terms of the contract, the operator may, if he

desires, personally settle injury claims made upon him, subject to certain limitations. This enables him to take into consideration the relations existing between the injured party and himself and to make settlement without regard to the legal phase of the matter. Of course, the operator will be given the benefit of suggestions in this respect, and care will be taken to see that he does not exercise undue liberality; but the experience has been that the operator treats this privilege wisely, and the result in dollars and cents is, on the whole, a reduction in the amount of the claims. At the expiration of the term of the policy a pro rata fraction of the amount remaining on deposit is returned to the subscriber.

PUBLIC SERVICE COMMISSION NEWS.

MASSACHUSETTS COMMISSION.

Hearings were given last week by the Massachusetts Gas and Electric Light Commission upon the applications of the Fitchburg Gas & Electric Light Company and the Malden Electric Company for authority to issue additional capital stock to cover the cost of improvements on each system. Mr. A. B. Tenney, of Boston, vice-president of the Tenney interests controlling these properties, appeared on behalf of the petitioners. One of the Fitchburg company's petitions requested the board to authorize additional stock of the par value of $32,350, on a $50 per share basis, at a price of $85 per share, to enable the company to purchase the 300-kw hydroelectric plant of the Wanoosnoc Power Company, with complete works and a transmission line about 2 miles long. A feature of the hearing was the testimony of Messrs. Hollis French and Allen Hubbard, consulting engineers, Boston, concerning the value of the hydroelectric property as an auxiliary to the system of the Fitchburg central station. The present value of the Wanoosnoc property was given as $59,420, consisting of reservoir interest, $10,900; dam, $9,700; steel penstock, 3800 ft., $13,000; station, $2,225; turbine and governor, $4,400; generator and switchboard, $4,320; pole line, $1,810; transformers, $2,360; frame house, $1,500; engineering, $3,000; stream lands, 40 acres, occupied by penstock, $6,000, and pole line rights across private lands, $205; total, $198 per kilowatt. The engineers stated that in an average year the hydroelectric plant will generate 573,000 kw-hr. and that the output can best be used in operating the company's Sunday load and in supplying for two hours on other days from 250 kw to 300 kw at the peak. The result is a saving in coal and oil of nearly $7,000 per year. No saving in labor was included, but the purchase of the plant will enable the company to shut down its steam station on Sundays and facilitate repairs and alterations while offering a reserve supply. Mr. French capitalized the difference in cost of operation between steam and water as follows: Present value of hydroelectric property, $59,420; cost of a 300-kw addition to the existing plant, $28,500; difference in investments, $30,920. The cost of producing 573,000 kw-hr. by steam was $7,162, at 1¼ cents per kw-hr., and the water operating costs, exclusive of fixed charges, depreciation, taxes and profit for the Wanoosnoc company, were $2,623, making a saving of $4,539 by water-power in operation alone. The capitalization of the saving on a 10 per cent basis to cover fixed charges, depreciation, taxes and profit totaled $45,390, which, less the difference in investment given above, gave a privilege value of $14,470.

The Fitchburg company also petitioned for the right to issue 2627 shares of stock of $50 par value, at the price of $85 per share, to provide funds for the payment of notes amounting to $222,000, issued on account of plant improvements within the past two years, and to meet the cost of extensions. In the electric department the company has expended about $124,000 in additions and improvements, including, among other items, 450 meters, $10,000; forty-three transformers, $4,000; overhead lines, $20,000; buildings and plant. Considerable cost data of value were presented, among which were the following items: New works office building, three stories and basement, 38 ft. by 20 ft., brick walls, steel frame, tar and gravel roof, $8,822; transformer house, 34 ft. by 25 ft., brick walls and partitions, gravel roof over tile, concrete floor and crane (6 tons capacity), $5,550, the crane and its erection totaling $393; electric elevator for office building, $893; Murphy furnace, installed, $1,857; changing 7-in. by 7-in. engine to 8-in. by 8-in. engine and necessary piping to connect engine to condensers of 1000-kw and 600-kw units, including valves, engineering, and labor, $311; installing 50-hp motor for induced-draft drive, $421, including belting, wiring, etc.; one 15-in. turbine waste-reclaiming machine, $150; one 9½-in. by 12-in. air-compressor pump, $100; three 300-kw, 13,200-volt to 2530-volt, single-phase transformers, $3,570; one 6600-volt electrolytic lightning arrester, with frame, switch and adjustable gap, $200; one 1-kw sign-lighting transformer, $44; line extension, 60,908 ft., including 261 poles of 25 ft. to 40 ft. and 38,928 lb. weatherproof wire, $22,360.

KANSAS COMMISSION.

In the case of the application of Mr. F. E. Workman to establish a new electric-service plant in the city of Parsons, Kan., previously referred to in this journal (page 296), the Public Utilities Commission of the State of Kansas handed down a decision on Feb. 5 denying the application. Practically the only reason assigned for permitting a new company to enter into competition with the existing Parsons Railway & Light Company was that the latter had notified the city authorities that after the expiration of its present arrangement on July 1, 1912, it would expect to establish higher rates. The commission in its ruling says that the whole controversy seems to be over rates. In the opinion of the commission the present laws give a city of the first class in Kansas sufficient power to regulate the rates of an electric light and power company. "From the showing," says the commission, "it does not appear that the public convenience would be promoted by permitting another light and power company to engage in business in Parsons."

WISCONSIN COMMISSION.

At the request of the Board of Water and Light Commissioners of the city of Marshfield the commission has investigated the rate situation in Marshfield and has recommended rates for water and electric service. Although the water and electric-light departments were considered by the municipality to be self-supporting, the investigation showed that under the proper cost accounting the revenues received by the water department were not sufficient to meet the cost of service, whereas the electric department was returning a material surplus. In arriving at the total cost of service the commission allowed interest at the rate of 6 per cent and depreciation at 1 per cent for the water and 4.5 per cent for the electric departments. Inasmuch as the plant is municipally owned, no taxes are paid, but the commission followed its usual policy in such matters and included a liberal allowance for taxes in computing the cost of service. In the case of the electric department it appeared that the commercial-lighting and street-lighting branches of the business furnished the total surplus. To distribute more equitably the burden between consumer and taxpayer the rates for water service were increased and those for electric service decreased. The unit costs for electric service were found to be as follows: 14.66 cents per kw-hr. for one-half hour's daily use of connected load; 9.18 cents for one hour's daily use; 6.44 cents for two hours' use; 5.53 cents for three hours' daily use; 4.25 cents for ten hours' use. The rates recommended are as follows: Primary rate, 10.5 cents net for the first thirty hours' use per month of the active connected load; secondary rate, 6 cents net for the next sixty hours' use; excess rate, 4

cents. In class A, consisting of residences, 60 per cent of the connected load up to 500 watts and 33⅓ of the excess are to be considered active; in class B, consisting of stores, etc., 70 per cent of the connected load up to 2500 watts and 40 per cent of the excess are to be considered active; in class C, consisting of churches, hotels, etc., and in class D, consisting of public buildings, 50 per cent is to be considered active; in class E, consisting of signs, etc., 100 per cent is to be active. The rate for the 6.6-amp arcs was fixed at $55 per arc per annum. Under the recommended rates the revenues from classes A and B will be considerably reduced, and each branch of the service will be paying its just share of the operating costs.

The commission has authorized the Wisconsin Public Service Company, with headquarters at Green Bay, to issue $400,000 par value of common stock, $600,000 par value of preferred stock, and bonds to the amount of $2,250,000. The bonds are to be dated Jan. 1, 1912, to mature Jan. 1, 1942, and to bear interest at the rate of 5 per cent. Provision is made for their redemption according to the terms provided in the mortgage or trust deed securing the issue and to be executed to the Wisconsin Trust Company of Milwaukee. The stock and bonds are to be issued for the purpose of using and applying the same toward the purchase of the property, rights and privileges of the Northern Hydroelectric Power Company; toward the purchase of certain outstanding notes of the Green Bay Gas & Electric Company, amounting to $191,500 and interest, secured by bonds of the Green Bay Gas & Electric Company; for the purpose of paying the debts of the Wisconsin Public Service Company now outstanding, and for the payment of the reorganization expenses of that corporation.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has received a petition from the Board of Trustees of the village of Norwich, Chenango County, against the Norwich Gas & Electric Company, alleging that the lights furnished by the company are inadequate for the purpose of lighting the streets of the village, do not give the candle-power provided for in the contract, and fail to burn at all on certain nights; also that the lights furnished for the public buildings are inadequate and do not furnish the quality of light paid for by the village. The petition states that many complaints have been made in relation to the efficiency and price of the electricity and gas supplied by this company, and asks that an investigation be made with a view to insuring to the village proper, adequate and economical lighting service. The complaint has been served upon the company and an answer required within twenty days.

The Postal Telegraph-Cable Company has again complained to the Public Service Commission, Second District, in relation to the charge made by the Western Union concerning the receiving and transmission to destination of telegrams handed over to the Western Union by the Postal for points not reached by the latter company. On Jan. 15 the commission made an order requiring the Western Union to discontinue the practice of charging for the date, the name of the state and the city where the message originated. Immediately after the making of this order the Western Union promulgated a new rule for New York State alone by which an extra charge should be made for the three words added at the point of transfer, and that is the rule and practice now in force by the Western Union in New York State alone. The three words charged for are "via" and the name of the place and state at which the transfer of message is made. The Postal company asserts that it is unreasonable for the Western Union to charge for the transmission of even two words, those being added by the telegraph company itself merely for its own purpose and convenience and for the purpose of identifying messages and keeping track of the same in its accounts and books, and says that any additional words should not be charged for any more than the address, date, signature and other words added by telegraph companies to messages for safety and convenience in the business are charged for, the same being transmitted free by all telegraph companies, the words so added to the messages and transmitted free by telegraph companies being on the average fourteen in number. The Postal alleges that the regular local rate of the Western Union on messages handed over to it is more than a reasonable part of the regular charge for the complete route of such messages, the result being that the Postal receives little or nothing—in some cases actually losing money—for its services in transmitting such messages over its own lines for a part of the entire distance from the points of origin to the points of destination of such messages. The commission is asked to make an order permanently restraining the Western Union from charging and collecting any amount on account of the additional words added to messages transferred to the Western Union by the Postal Company.

The hearing scheduled for Feb. 14 before Commissioner Maltbie, of the First District, on the complaint that discriminatory rates are given by the New York Edison Company to large users of energy, was postponed until Feb. 19.

CALIFORNIA COMMISSION.

The law giving the State Railroad Commission of California power to regulate and control all public utilities will become effective March 23, 1912. The commission will be enlarged from three to five members. One of the members will devote his time to the inspection of the equipment and service of the railroads. A second commissioner will take charge of the other features of railroading. Two others will give their time to utilities other than railroads. The chairman of the board will occupy himself with matters of general policy.

OHIO COMMISSION.

The Ohio Public Service Commission has approved the sale of the Central Union telephone properties to a number of independent companies. A commission has so far refused to allow an increase of rates as a result of consolidation, and it is claimed that this is delaying matters in the larger cities. Engineers maintain that operating expenses increase as additions are made to the number of telephones in use and for that reason an increase in rates should be taken into consideration.

MARYLAND COMMISSION.

For the first time since its creation the Maryland Public Service Commission is preparing to go into court to enforce its orders. The situation arises from a long-drawn-out controversy between Mayor Higgens and the citizens of Easton and the Easton Light & Fuel Company over the service and charges of the company. When the matter came before the commission Chief Engineer Phelps was instructed to examine thoroughly the plant of the company and to determine the feasibility of its serving the public as desired. Mr. Phelps reported that not only could the service sought be rendered, but by proper organization of the company and its plant the company could increase its earnings while granting better service. This would necessitate an initial outlay for improvements. The commission passed an order in accord with Mr. Phelps' suggestions, which was not heeded by the company. Finally the commission advised it that unless the order was obeyed within ten days action would be commenced in court. Some slight steps were taken by the company, but these were not sufficient in the judgment of the commission, and General Counsel Bruce was ordered to proceed with action in the Circuit Court for Talbot County. It is assumed that the company will plead in defense that the order of the commission is unreasonable and impossible of performance. The law provides a fine of $1,000 a day for non-compliance with the commission's orders.

THE RETIREMENT OF PRESIDENT DUNHAM.

Thirty years of conspicuous leadership in the highest councils of the central-station industry stood to the credit of President Austin C. Dunham of the Hartford Electric Light Company upon his retirement on Feb. 13 from the executive chair. The event carries more than ordinary significance. It marks the conclusion of an administrative period almost without a parallel in the great business of manufacturing and distributing electrical energy for the benefit of the ultimate consumer, and it promises still further achievement for the industry through the release of one of its most honored workers from the burdens of routine management. For no one who knows Mr. Dunham doubts for a moment his continued activity in the difficult and important field of electrical research. Through his efforts and the co-operation of those associated with him Hartford has become the city of moderate size best known to the central-station industry, a proving ground for the latest equipment and methods, and probably the nearest approach to an "electrically saturated" community that can be cited in a comprehensive comparison. The prosperity of the Hartford company, with its gross revenue of nearly $10 per capita in a community of 115,000 persons and its annual output of some 40,000,000 kw-hours, is a matter of record and a final answer to the skeptical conservatives who have questioned the orthodoxy of its commercial management. The history of the organization, with its brilliant record of scientific discernment and its courageous application of advanced practice, cannot be written in a few paragraphs, but some of its salient points mark the beginning of new eras in central-station operation and may well be recalled in connection with President Dunham's distinguished career.

Of stanch New England ancestry, Mr. Dunham was born in Coventry, Conn., in 1833, and, after a secondary education in the Hartford High School and elsewhere, entered Yale University, being graduated in the class of 1854. He taught for a year at Elmira, N. Y., returned to Hartford, and has ever since been identified with the manufacturing, banking, insurance and philanthropic interests of the city and one of the foremost figures in the social life of the community. A brief outline of Mr. Dunham's interests outside the electrical field was given in the announcement of his contemplated resignation in the *Electrical World* of Jan. 13, 1912. He entered the electrical industry in 1882, becoming the executive head of the Hartford Electric Light Company at a time when the connected load consisted of forty-five commercial arc lamps supplied with energy by a second-hand United States dynamo belt-driven by a 50-hp Armington & Sims high-speed engine, the plant being housed in a wooden lean-to in the business district and operated by steam purchased from a local heating company. Mr. Dunham became a director in the Thomson-Houston Electric Company at the time of its establishment at New Britain, Conn.

Under Mr. Dunham's personal administration, the Hartford company soon began to develop with striking rapidity, and its system quickly became a sort of central-station laboratory for the country, with the significant feature, however, that the great majority of the experiments were commercially successful. At Hartford modern methods of energy transmission from water-power were first practised, and the company was the first to employ polyphase transmission apparatus, the first to introduce extensively alternating-current inclosed arc lamps, 60-cycle rotary converters and the constant-current alternating arc-light system. The first steam turbo-generator placed in service in America went into the Hartford plant, and the Nernst lamp made its first appearance in the Connecticut city. The first storage battery in central-station work was installed at Hartford, and the first tungsten street lamps were used in this birthplace of progressive ideas. Here also have occurred experiments in flat-rate residence lighting and electric cooking that have challenged the interest of the world, and on this historic system a power load has come into being which has turned the company's territory into a desert land so far as the demand for steam, gas and oil engines is concerned. The industrial smoke nuisance has ceased to trouble the citizens; the conditions of living have been noticeably improved; even the colored washerwomen of the city are using electricity for heating, lighting and power service, and yet only a fair start has been made. Nowhere can one find better evidence of the fact that electrical development is a world movement of unbounded possibilities.

In 1889 the company contracted for the total amount of power that could be furnished by the Farmington River Power Company, at its plant located 10.8 miles from Hartford, and in 1890 this power was first utilized to operate the generators employed in street lighting. By this contract the Farmington River company agreed to deliver 600 hp at Hartford for 365 days yearly, covering a total of 2,628,000 hp-hours at a total price of $12,000. The company had the

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privilege of receiving the energy in proportion to the street-lighting hours, and about eight circuits were installed between the water-power plant and the city. Some of the stockholders at once sold out their interests through fear of these radical developments. None the less, the results of the work done in 1890 were so satisfactory that in 1891 a single-phase alternator was started and operated at 2500 volts. In the next year 1200-volt generators were installed, and by the use of transformers the potential was raised to 7000 volts, step-down transformers being installed at the Hartford end of the line to deliver energy at 1200 volts. Early in 1893 a three-phase generator of 300-kw capacity was installed at the power house and utilized in the operation of a three-phase motor connected to a shaft in the Hartford station, and this was an aid to the steam plant then operating the company's direct-current generators.

The success of the Farmington River transmission led the company in 1896 to increase materially the size of the plant and to make a number of changes in the interest of flexibility and economy. The problems to be overcome consisted in increasing the water-power, making the load more constant, effecting a more efficient transmission, raising the

efficiency of the existing steam plant and placing some of the wires in the center of the city underground. To aid in securing these results, advantage was taken of the ease of balancing a two-phase system and the possibility of supplying lamps on independent circuits when using this system for distribution, while the benefits of three-phase operation, both as to line inductance and the amount of copper required, were attained by using the latter system in transmission. The power required for the street railway and arc-lighting circuits and the low-potential, three-wire distribution necessitated the continuance of direct current for these purposes. The power transmitted from the main station at Farmington River was in part distributed directly for lighting, in part used to operate two-phase rotary converters which in turn supplied a storage battery, and in part to supply a large synchronous motor direct-coupled to a shaft which in turn operated railway generators and arc machines. The synchronous machine automatically acted as a motor or as a generator in accordance with the load. When operated as a generator it was run by the auxiliary steam engines and was connected in parallel with the main power generators 11 miles distant. It supplied the city service directly in case of an interruption on the line. Under ordinary conditions the motor enabled the steam plant to be shut down.

When required the storage battery was used to supply the rotary converters, which in turn were available to operate the synchronous motor. The rotary converters and the battery were operated on the three-wire distribution system. The capacity of the Farmington River plant was increased by raising the dam and by the installation of two 600-kw. three-phase alternators belt-driven by four sets of horizontal turbines. The line potential was raised to 10,000 volts by four 300-kw transformers, but no attempt was made to handle the 10,000-volt output by switches. Wurtz lightning arresters were used and the last 3000 ft. of the line was run underground. At Hartford the potential was reduced to 2400 volts, two-phase, for local service, and the frequency was reduced in the design of the new system from 133 cycles to 60 cycles. A feature of the installation at Hartford was the use of a thirty-six-point regulator in connection with the rotary equipment, which eliminated the necessity of boosters in charging the storage battery. The simplicity, range and flexibility of the installation were unique, and nowhere else at the time could be found the means of transforming from a high-tension, multiphase, alternating to a low-tension, three-wire, direct-current system of variable voltage by one regulator, two step-down transformers and a single machine with but two sets of brushes upon the commutator. Cables were used as feeders in the underground ducts in place of the usual Edison tubes. The reduction of the frequency also made it possible to employ induction motors on the system. The introduction of the storage battery greatly increased the average load on the water-power and diminished the use of steam at the peak of the load. The changes made materially reduced the cost of operation and greatly improved the reliability and quality of the service.

The company decided in 1896 to make a radical change in its system of series arc lighting in order to obtain greater economy of operation. Propositions were considered for using motor-driven series arc dynamos and for using rectifiers, but the latter were never put into service, although an attempt was made to import one from Europe. The development of the inclosed arc lamp quickly led to the evolution of the constant-current, alternating arc lamp and constant-current transformer, and in 1898 an experimental thirty-light tub transformer was placed in service in Hartford. Its success was marked and led at once to an extension of the system. The lamps operated from the tubs were of the carbon-feed inclosed differential type and gave much trouble at first by the burning out of the sliding contact by which electrical connection was made with the upper carbon. At Mr. Dunham's suggestion a flexible wire contact was made and the operation of the lamps at once became satisfactory. The power required for street lighting was reduced by the change in the system about 27 per cent. Another innovation was the installation of tub transformers in outlying substations, whereby the wiring system was much simplified, the cost of transmitting energy through the underground district reduced, and a saving made in maintenance and operation of dynamos. The maintenance of the tub transformers and labor of overseeing their operation were trifling. The total saving in operating expenses paid for the entire cost of the change in two years and gave the city a much improved service.

In 1899 the company began to operate a water-power plant of about 1500-kw rating at Tariffville, also on the Farmington River. The growth of the system gradually required the use of more and more steam power, and the limitations in capacity of the hydroelectric plants led the company in 1905 to decide to build a new steam plant at Dutch Point, on the Connecticut River, within easy access of the center of the city. In the natural expansion of the old steam station at Hartford, however, an epoch-making event had occurred in 1900, when the company purchased from the Westinghouse Machine Company the first steam turbo-generator ever operated in American central-station service. At that time the main output of the company was handled by water-power, the steam plant being operated in a normal year continuously for about three months and at the peak of the load for about the same period. The steam-turbine set consisted of a 1500-kw horizontal Westinghouse-Parsons turbo-alternator operated at 1200 r.p.m., delivering two-phase current at 60 cycles. The unit cost $49,500 and had a net weight of 179,800 lb., compared with a cost of about $40,000 to-day for the company's latest 4000-kw horizontal turbo unit, the pioneer machine weighing nearly 20 tons more than its 4000-kw successor. Tests showed that the rating of the original unit was about 2000 kw at normal load, and the steam consumption per kw-hour at this output was 19.1 lb., with a maximum superheat of 55 deg. to secure absolutely dry steam, 155 lb. steam pressure and a 27-in. vacuum, exclusive of the steam consumption of auxiliaries. The pioneer unit was transferred to Dutch Point when that station was built, and the old steam-engine plant was abandoned.

The Dutch Point station is a steam-turbine plant throughout and has a rating of about 20,000 kw. It was described in the *Electrical World* of March 3, 1906, and marks a turning point in the history of the company. As the system has grown Mr. Dunham has become more and more convinced that, with the development of the steam turbine, water-power, except in unusual if not in very rare circumstances, must assume the place of an auxiliary source of electrical generation. With large turbo-units the fuel efficiency and the labor cost per kw-hour are so favorable to the turbine, with its assured reliability at all seasons and independence of weather conditions, that upon steam must be placed the burden of future development to meet rapidly growing markets for electrical energy. These views were set forth in Mr. Dunham's important paper on "The Comparative Values of Water-Power and Steam-Power for the Development of Electricity," published in the *Electrical World* of Jan. 6, 1912. As a result of the experiences there given it apears certain that the further expansion of the company's generating system will take place along the lines established in the Dutch Point station. In connection with the development of the company's turbine practice Mr. Dunham has given much attention to the problems of combustion, fall of steam pressure in piping and other matters intimately related to station economy, with the result that the mere station cost of production, exclusive of any fixed or administrative charges, has fallen from about 1 cent per kw-hour in 1905 to about 4 mills. Throughout its career the company has by substantial rate reductions shared

with its customers the benefits of economical changes in its service.

Only passing mention can be made of the company's recent commercial developments, since these have been described at length in the *Electrical World* during the past three and one-half years. Among the striking features of Mr. Dunham's work in this period have been the establishment of flat-rate residential lighting with low-voltage tungsten lamps, experimental investigations upon the cost of electric cooking with high-powered ranges and by low-powered fireless cookers, the installation of magnetite arc lighting for street service, investigation of the possibilities of electric vehicles, and the constant extension of the motor drive in factory and other service. The motto of the company has continually been to give the other party to each contract half the advantage. The results of this policy are reflected in the company's financial condition. From residence lighting alone the company now derives an income of nearly $140,000 per year. In the past ten years its income has risen from all sources to about three times what it was at the beginning of the decade. In the *Electrical World* of Nov. 28, 1908, March 18, 1909, and Sept. 1, 1910, will be found various details of the pioneer work thus far available for publication in the fields of heating and lighting. The outlook for future development in the fireless cooker field indicates that in the coming months Mr. Dunham will carry this important investigation far into the commercial world, and that it will not be long before the central station will be in possession of an advanced type of equipment capable of meeting the most exacting conditions as determined by more than two years of analysis and experiment. It is a cause for congratulation that Mr. Dunham purposes to devote a considerable share of his time to some of the most pressing problems now confronting the art, and in marking his retirement from executive responsibilities to devote himself to the congenial work of research and other duties the industry may well rise to its feet and, with all respect, hail him as the "Grand Old Man of the central-station field."

Current News and Notes.

ARKANSAS PUBLIC UTILITY OPERATORS.—The Arkansas Association of Public Utility Operators will hold its fifth annual meeting at Little Rock on May 20, 21 and 22. The president of the association is Mr. J. M. Hewitt, Marianna, and the secretary Mr. W. J. Tharp, Little Rock.

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EMPLOYEES' WELFARE.—The managers of the various properties of Messrs. Henry L. Doherty & Company held a meeting in New York on Feb. 15 and 16 to consider the subject of welfare work for employees. The recent report of the public policy committee of the National Electric Light Association, of which Mr. Doherty is a member, was taken as the basis for discussion. The conference dealt specifically with means of reducing accidents and sickness, and a visit was made to the Museum of Safety.

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PUBLIC UTILITY ACCOUNTANTS.—The New York Public Service Commission, Second District, announces openings for some young men between the ages of twenty-five and thirty-eight with training in corporation accounting. A list of eligibles for the position of examiner at a salary of $1,800 and expenses when engaged in field work has been arranged for by the Civil Service Commission. Separate eligible lists will be established for steam railroad accounting, street and electric railway accounting, electric and gas corporation accounting and telegraph and telephone corporation accounting. For full information in relation to these examinations application should be made to the State Civil Service Commission at Albany on or before Feb. 24, 1912.

REDUCTIONS IN RATES.—On March 1 the maximum lighting rate will be reduced from 11 cents to 10 cents a kw-hr. by the Edison Electric Illuminating Company of Boston. This is a voluntary reduction by the Boston company, and it is interesting to note that the corresponding rate in 1906 was 18.2 cents. The Edison Sault Electric Company, of Sault Ste. Marie, Mich., has reduced its rates to private consumers about 15 per cent, while the price to the city for each arc lamp used for street lighting has been cut from $50 to $45 a year. These reductions have been brought about as a result of an agreement with the United States government for the lease of 5000 hp developed from the rapids of St. Mary's River, indicating uninterrupted operation of the company's water-power supply for the next thirty years. The Toledo Railways & Light Company has filed its acceptance of a lighting ordinance which provides for a rate of 8 cents per kw-hr., with a discount of 1 cent for prompt payment and a minimum charge of 50 cents a month. This ordinance was accepted with the understanding that the city will make up the difference if it should be found later that the company is entitled to the rates which it thinks are equitable.

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ELECTRIC CLUB OF CHICAGO.—At the annual meeting of the Electric Club of Chicago on Feb. 7 it was voted to hold the weekly luncheons on Thursday instead of Wednesday as heretofore. Secretary Norman F. Obright reported a net gain of six members during the year and a present membership of 336. The attendance at the weekly meetings has averaged fifty-seven, not including the occasion of the Electric Club's luncheon to the American Institute of Electrical Engineers last June, when 480 persons were present. The retiring treasurer, Mr. Otis B. Duncan, reported $3,756.39 in the club's treasury, representing a gain of over $500 in the year. Mr. G. H. Jones, chairman of the membership committee, and Mr. H. A. Mott, chairman of the entertainment committee, spoke briefly on the work of their committees. By unanimous vote of the club, officers were elected as follows for 1912: President, Mr. A. A. Gray; vice-president, Mr. P. R. Boole; secretary, Mr. W. M. Connelly; treasurer, Mr. J. R. Harmon; board of managers, Messrs. H. G. Hafner, D. W. Roper, N. F. Obright, J. R. Cravath and J. H. Delany. Brief addresses were made by those of the new officers present and by Mr. Homer E. Niesz, the retiring president of the club.

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ELECTRICAL MACHINE FOR CREATING ARTIFICIAL RESPIRATION.—Drs. H. M. Richter and F. A. Besley, Chicago, have devised a motor-operated device for maintaining artificial respiration during operations of lung surgery. The compressor element of an electric vacuum cleaner is employed to furnish air at pressures of 6 mm to 12 mm of mercury, and the control of this supply to the lungs, to simulate natural respiration, is effected by an electromagnetically operated valve, the circuit of which is closed at intervals by clockwork. The period of this artificial respiration can be regulated to suit the case by adjusting the mechanism. Recently the machine was used to sustain the life of a dying patient twenty-nine hours beyond the time at which all signs of animation had ceased. Meanwhile the surgeons were undertaking to provide relief through surgical means, but their efforts proved unavailing, and twenty-nine hours after the original natural cessation of the functions death was declared actually to have taken place. This instance is believed to have been an extreme record for prolonging life, including the restoration of the heart's action. It is hoped that the use of the machine may mean the difference between life and death in many cases of asphyxiation, drowning, anæsthesia, shock and poisoning. The present invention differs from the pulmotor, recently described in these columns, in several respects. For one thing, it introduces atmospheric air instead of oxygen into the lungs.

Long Life of Telephone Dry Battery.—At the recent Chicago telephone convention the question came up as to the life of dry batteries in use on farmers' telephone lines. The answers varied from six months to two years. One man said the average life of the telephone dry battery was ten months, but another made the interesting statement that he knew of a dry battery in such service which had lasted for five years.

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Rate Research Committee.—A meeting of the rate research committee of the National Electric Light Association was held at the office of the chairman, Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company in Chicago, on Feb. 7 and 8. There was a wide range of discussion, and it was decided to hold the next meeting at the same place on March 4 and 5, and at that time it is expected that the report will be drafted.

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Interchange of Telephone Data.—During the recent convention of the National Independent Telephone Association in Chicago one of the subjects discussed at the "technical conference" was the use of automobiles and motorcycles in telephone work. The discussion related to gasoline machines entirely, but the report of the committee in charge of the subject contained, among other responses, one from the New York Telephone Company giving an interesting indication of an interchange of technical data between Bell and Independent companies which would have been unheard of a few years ago.

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New York Jovian Luncheon.—At the regular semimonthly luncheon of the New York Sons of Jove held on Feb. 7 the speaker was Mr. Philip S. Dodd, whose topic was "Possibilities of Co-operation." Mr. Dodd made an interesting address and told his audience that, while luncheon clubs were excellent for promoting harmony, they should have some other definite object of commercial benefit to the members of the organization. Mr. Dodd also spoke at length on the "People's Electrical Page," which is appearing in a great many daily newspapers in different cities of the country at regular intervals.

* * *

A Yankee Trick.—The great German electrical manufacturing companies seldom admit visitors to their works, fearing the loss of some of their trade secrets. On the other hand, American manufacturers seem to welcome interested visitors, and this liberal policy at home led an American engineer, while traveling abroad several years ago, to ask admittance to the shops of a great German company. With Continental formality his card was received by an assistant executive, who initialed it and sent it up through several officials, it finally reaching the general manager. The latter promptly sent out a message of flat refusal. Simulating indignation, the American demanded the return of his card, declaring that he wanted to leave nothing of his in that office. The card was passed out to him with its string of Teutonic initials. On the way out he passed the employees' entrance to the shops. Presenting the card here and pointing to the row of initials, he was received with extreme courtesy by the shop foreman, who later piloted him throughout the factory and answered all his questions with the greatest freedom.

* * *

Conservation of Vision.—A symposium on the conservation of vision and prevention of blindness was held in Chicago on Feb. 8, under the auspices of the *Chicago Daily Tribune*, the Chicago Women's Club and the South Side branch of the Chicago Medical Society. With a pathetic propriety the meeting was held in that room of the Public Library where are to be found the books for the blind. A number of physicians gave short addresses on subjects connected with the preservation of sight, both of individuals and communities. Mr. J. R. Cravath, former chairman of the Chicago Section of the Illuminating Engineering Society, read a short paper on "Illumination and Vision," in which he dwelt particularly on the injurious effects of the reflection of direct lighting from polished surfaces and the white paper of books and magazines or writing paper on desks. Mr. Robert J. Young, manager of the department of safety and relief of the Illinois Steel Company, demonstrated the methods adopted to prevent injuries to the eyes of workers in steel mills. Among other things he showed a mask used by workmen in looking at the dazzling arc of the electric furnace. In this mask the eyepieces are each provided with three pieces of glass, two of them being ruby-colored glass, with a dark blue glass between them. Mr. Edward Wray, secretary of the Chicago Section of the Illuminating Engineering Society, also spoke briefly.

* * *

Safety Engineering.—The new American idea of the "safety engineer," an accident prevention specialist, will be brought to the notice of the world at an International Safety Congress to be held in Milan, Italy, for five days, beginning May 27, 1912. This congress, the first of its kind of international scope ever held, will be for the purpose of setting in motion a world-wide movement for the conservation of human life in industry. The American Museum of Safety, 29 West Thirty-ninth Street, is making preparations to the end that the United States shall be well represented. An American national committee has been selected by the American Museum to co-operate with the international body and to promote the American ideas and views at the congress. Dr. W. H. Tolman, director of the American Museum of Safety, and other members of the committee will attend the congress. The following are some of the papers which will be read at the Milan congress: *The Safety Engineer on a Large Transportation System*, by Dr. W. H. Tolman, chairman American National Committee; *How the New York Edison Safeguards the Lives and Limbs of Its Employees*, by Mr. Arthur Williams; *The Work of the Safety Committee of the United States Steel Corporation; Safeguarding the Traveling Public and Protecting the Employees of the Electric Street Railway Association; Proper Illumination and Accident Prevention*, by V. R. Lansingh, president Illuminating Engineering Society.

* * *

Electrical Progress in Massachusetts.—Substantial gains in electrical production are indicated by the current publication of the twenty-fourth annual report of the Massachusetts Bureau of Statistics, division of manufactures, based upon United States Census returns for 1910, including the calendar year 1909. The product value of electrical machinery, apparatus and supplies increased from $15,882,216 in 1904 to $28,142,889 in 1909, or 77.2 per cent, while the value of all manufactured products in the State increased but 32.6 per cent in the period. With the exception of automobiles and boot and shoe findings, electrical manufactures increased in value more rapidly than other products. In the past fourteen years electrical products show a fourfold increase. The product value of electrical goods manufactured in the city of Pittsfield alone has risen 77.4 per cent in the five-year period. The number of working days in 1909 was 305, the highest average running time being 299 days. In the electrical industry the average was 295 days. The amount of capital invested in electrical manufacturing in the State in 1909 was $32,961,277, and there was paid in wages $8,209,174 to 14,507 employees in ninety-seven establishments. The value of stock and materials used was $12,734,820. In the electroplating industry there were 54 establishments, with an invested capital of $431,043, 467 employees receiving $238,670, and a stock and material value of $163,653, the product value being $678,346.

HYDROELECTRIC PLANT OF NORTH CAROLINA ELECTRICAL POWER CO.

Energy Transmitted at 66,000 Volts and Distributed in Asheville, Canton and Surrounding Territory for Lighting and Motor Service.

By N. Buckner.

THE third hydroelectric plant of the North Carolina Electrical Power Company, of Asheville, N. C., on the French Broad River 25 miles northwest of Asheville, N. C., which has been under construction for two years, has just been completed and put into service. The normal rating of the plant is 5000 hp. The entire plant represents in round figures an expenditure of $500,000, or $100 per horse-power. In order to find a suitable site it was necessary to raise and rebuild 2.5 miles of the track of the Southern Railway, which skirts the river at this point. The track at the dam was raised 20 ft. higher than the old roadbed, the total excavation amounting to about 60,000 cu. yd., 80 per cent of which was of solid granite. The change in roadbed alone cost $75,000 and required one year to complete. All of the re-location work was done without interference with traffic, although there were operated over this line an average of from thirty to forty trains per day.

The dam is 530.15 ft. long, 30 ft. high, 43.75 ft. thick at the base and 11 ft. at the top. It is built of cyclopean concrete, the large stones in some instances approximating 5 cu. yd. Approximately 22,000 barrels of cement were used in the construction of the dam, the foundation of the power plant and the retaining wall for the protection of the roadbed. The downstream face of the dam is curved in such a manner as to insure that the water will always cling to the surface and prevent the formation of a vacuum under the falling sheet, since it is generally conceded by engineers that the formation of a vacuum on the downstream side is responsible for the trembling often felt in the vicinity of an over-fall dam.

In the dam next to the power house are two circular mud gates, 7 ft. in diameter, which are opened and closed by an electrically driven pump in the power house. The gates and cylinders are entirely submerged. The four penstock gates are among the largest cast-iron gates made; each gate

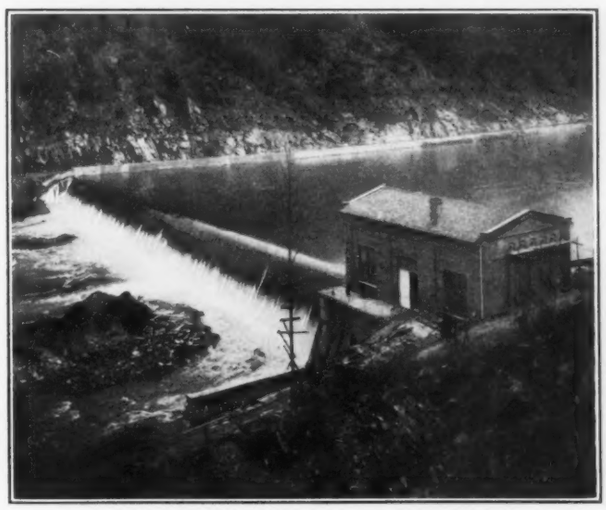


Fig. 1—View of Dam and Power Station.

covers a clear opening of 18 ft. by 7.25 ft. and weighs 13 tons. They are operated in pairs by an electric motor.

The power house, which covers ground area of 40 by 76 ft., is fireproof throughout. It is built of concrete to the floor line and brick from that point up. The windows are of steel and prismatic glass. From the floor to the eaves the height is 31 ft.; from the bottom of the foundation to the comb of the roof the height is 100 ft. A 50-ton elec-

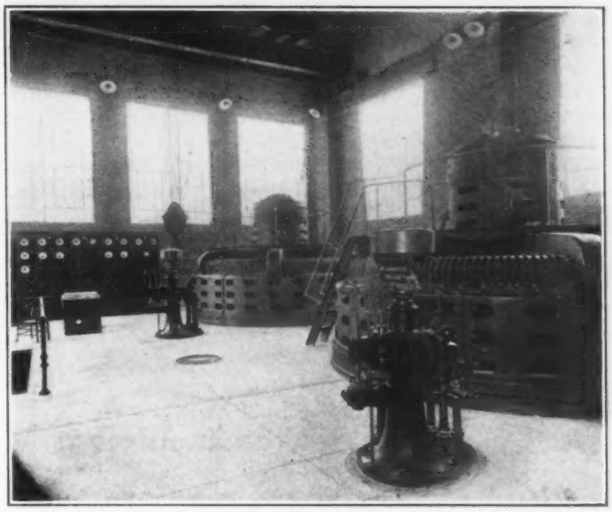


Fig. 2—Generator Room.

trically operated traveling crane extends the entire length of the building.

The generating equipment consists of two 1875-kw Westinghouse three-phase alternators designed for 6600 volts, 60-cycle, directly coupled to two Morris turbines. The units have vertical shafts with the exciters located on top of

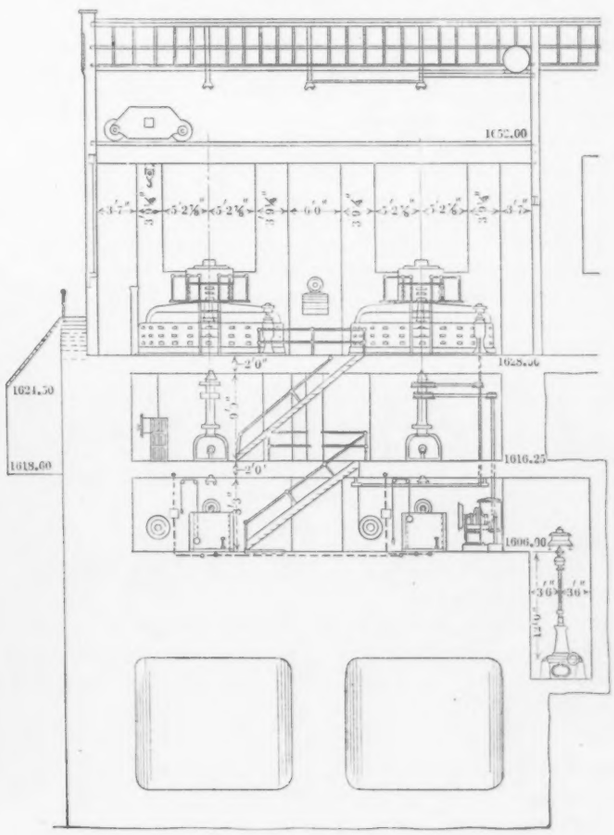


Fig. 3—Sectional View of Plant.

the alternators. The emf is stepped up to 66,000 volts for transmission. The entire control of the plant is from the switchboard, all gates, switches, motors and valves being electrically operated. All wires, both high and low tension,

are run through conduits placed in the floor and walls at the time of construction of the building. All wires in all cables are in different colors, which eliminates mistakes in connection.

Duplicate transmission lines have been built on private right-of-way, one on the west side and the other on the east side of the river, to Plant No. 2 of this company, 6 miles northwest of Asheville, where there is a substation for distributing the energy to Asheville, Canton and other places. The other two hydroelectric plants owned by this company develop 4000 hp, all of which has been utilized in Asheville. This new plant has been made necessary by the increased demand in Asheville and surrounding territory for electric lighting and motor service.

This plant was designed by Mr. Charles E. Waddell, chief engineer of the company, Asheville, N. C. Capt. W. T. Weaver is the president of the company and Mr. Charles Folsom is the resident engineer.

ELECTRIC GENERATING STATION CONSTRUCTION AT MONTGOMERY, ALA.

New Steam-Turbine Station of the Citizens' Light, Heat & Power Company Completed Within Seven Months After the Placing of Contracts.

By W. H. Fisher.

THE Citizens' Light, Heat & Power Company has just completed at Montgomery, Ala., a generating station which was erected in the remarkably short time of seven months from the date on which the contracts were placed. The contracts for the foundations, brickwork, roof, steel skeleton, machinery, carpenter work, pipe fittings, etc., were let to sixteen different firms, five of which were local Montgomery companies. Some of the contracts signed involved forfeits amounting to as much as $50 per day for each day over the time set for the completion of the work. Unusual time limits were imposed in all of the agreements. For instance, forty-five days was allowed for the brickwork, sixty days for the steel, and thirty days for the installation of the boilers. The limits in all other contracts were equally severe. In spite of the difficulties which naturally came up, the construction progressed with unusual rapidity, and in seven months the building was practically finished. The plant is now running and is carrying the full load.

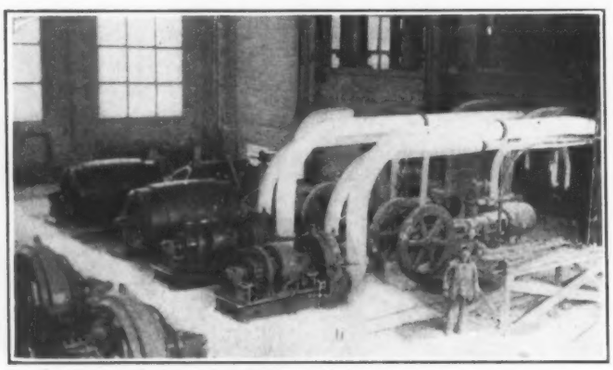


Fig. 1—View of Engine-Room Showing Turbines, Exciters and Pumps.

The boiler-room unit is 80 ft. wide by 100 ft. long. One-half is taken up by the present installation and the remaining half is left for a similar one on the opposite side. There are now in operation four batteries of Stirling water-tube boilers of the hand-fed type. On account of the low cost of labor in Montgomery the need of automatic stokers is not keenly felt and hand-firing is probably as economical as mechanical firing. Draft is furnished by a steel stack 200 ft. in height and 11 ft. in diameter at the top. The batteries consist of two boilers each of 400 hp rating. The boilers are provided with superheaters for 125 deg. super-temperature, and have over 4000 sq. ft. of active heating surface in the tubes. They are also provided with swinging dampers and frame arranged for connection of breeching and with operating lever conveniently located for handling from the main floor.

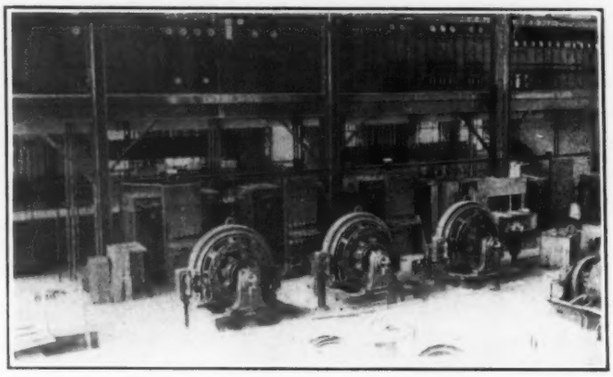


Fig. 2—View of Engine-Room Showing Three 500-kw Rotary Converters, Transformers and Switchboard Gallery.

On the gallery floor, in the engine-room, above the level of the top of the boilers, are two horizontal, open-type Cochrane feed-water heaters and purifiers to form a double installation, each one designed for heating 150,000 lb. of water per hour from 50 deg. to 205 deg. when kept full of exhaust steam at atmospheric pressure.

Coal is brought into the building over an elevated track and dumped into bins which are immediately beneath. Provision has been made for the future installation of an ash blower in front of the boilers. The trench for the blower is curbed with steel and covered over with a plate at the level of the ash doors.

In the engine-room, under the heater gallery, are two 17-in. by 10-in. by 15-in. boiler-feed pumps of the center-packed plunger, pot-valve type, and abreast with these are the low-service pumps. They are 8 in. by 10 in. by 12 in. and of the horizontal duplex piston pattern. There are also two vertical, center-current barometric condensers, capable of condensing 32,000 lb. of exhaust steam per hour, maintaining a vacuum of 28 in. referred to 30-in. barometer when supplied with not less than 4200 gal. of injection water per minute at not more than 75 deg. Fahr. There are two 10-in. by 24-in. by 18-in. single, horizontal, straight-line rotative dry-vacuum pumps with water-jacketed air cylinders, fitted for superheated steam, located immediately back of the boiler-feed pumps in the main part of the engine-room.

In a concrete well 25 ft. in diameter down at the river bank, and below low-water level, are to be installed two 12-in. double-suction, vertical centrifugal pumps, to deliver 4200 gal. of water per minute under a head of 100 ft., when operating at 1150 r.p.m., with 75 per cent efficiency. Each one of these pumps is to be operated by a 150-hp motor. The concrete well has been finished for more than four months and all of the supply line running far out into the Alabama River is in place; but, on account of delay in the shipment of trusses for the bridge leading from the main building out to the pump well, for a time nothing was done toward placing the supply pumps or building the brick pump-house which goes on top of it. However, as soon as the bridge was completed the plant, which up to that time was operating non-condensing, was put under full load. The hot-wells and the 36-in. overflow leading back to the river were all in place and tested out, and just

as soon as the supply pumps were connected up and tested the plant was ready to operate full capacity.

The electrical equipment consists of the following machinery: Two 2000-kw turbo-alternators; two direct-current turbo-generators; three 500-kw rotary converters; two 200-kw rotary converters; six 250-kva transformers; four 100-kva transformers; one switchboard consisting of fifty-three panels, and starting panels for the converters.

The two large steam turbines are of the multiple-expansion, multiple-flow type, and are adapted for driving a directly connected generator. They operate with a throttle pressure of 175 lb., there being a vacuum in the exhaust pipe of 28 in. The super-temperature at the throttle is 100 deg., and the normal speed is 3600 r.p.m. Under the fore-going conditions the normal rated output is 3000 hp and the maximum is 4500 hp. Running non-condensing and with only atmospheric pressure in the exhaust line, 2250 hp may be reached.

The rotary converters are compound-wound, self-starting from the alternating-current end with a speed-limit device, and the transformers are single-phase, oil-insulated and self-cooling.

Room has been left and the concrete foundations have practically all been built for a similar installation on the opposite side of the building, so that in the future the equipment of the plant may be doubled. The cost of such an addition would not be much more than the cost of the machinery. A 20-ton electric traveling crane completely covers the area of the turbine-room, and it will be an easy matter to install any future machinery, as it may be unloaded directly from cars on a spur track which runs into the engine-room a whole car length. This plan was used with all of the machinery that is now in place.

The design was intrusted to the Schofield Engineering Company, the work being in charge of Mr. John Stockton. The resident engineer was Mr. J. M. Chumley, the chief engineer of the Citizens' Light, Heat & Power Company. The president and owner of the company is Mr. Richard Tillis, who is also president of the Montgomery Traction Company, and who assumed full responsibility for the plant.

ELECTRICAL EQUIPMENT OF A GREAT GROUP OF OFFICE BUILDINGS—V.

Subway System and Vertical Riser Chases in the Buildings of the Prudential Insurance Company at Newark, N. J.

BY HENRY C. MEYER, JR., AND BASSETT JONES, JR.

FOUR articles devoted to the history of the Prudential installation and to various construction details have appeared previously. The present instalment gives a short description of the subway system and vertical chases and the difficulties encountered on account of the cramped conditions.

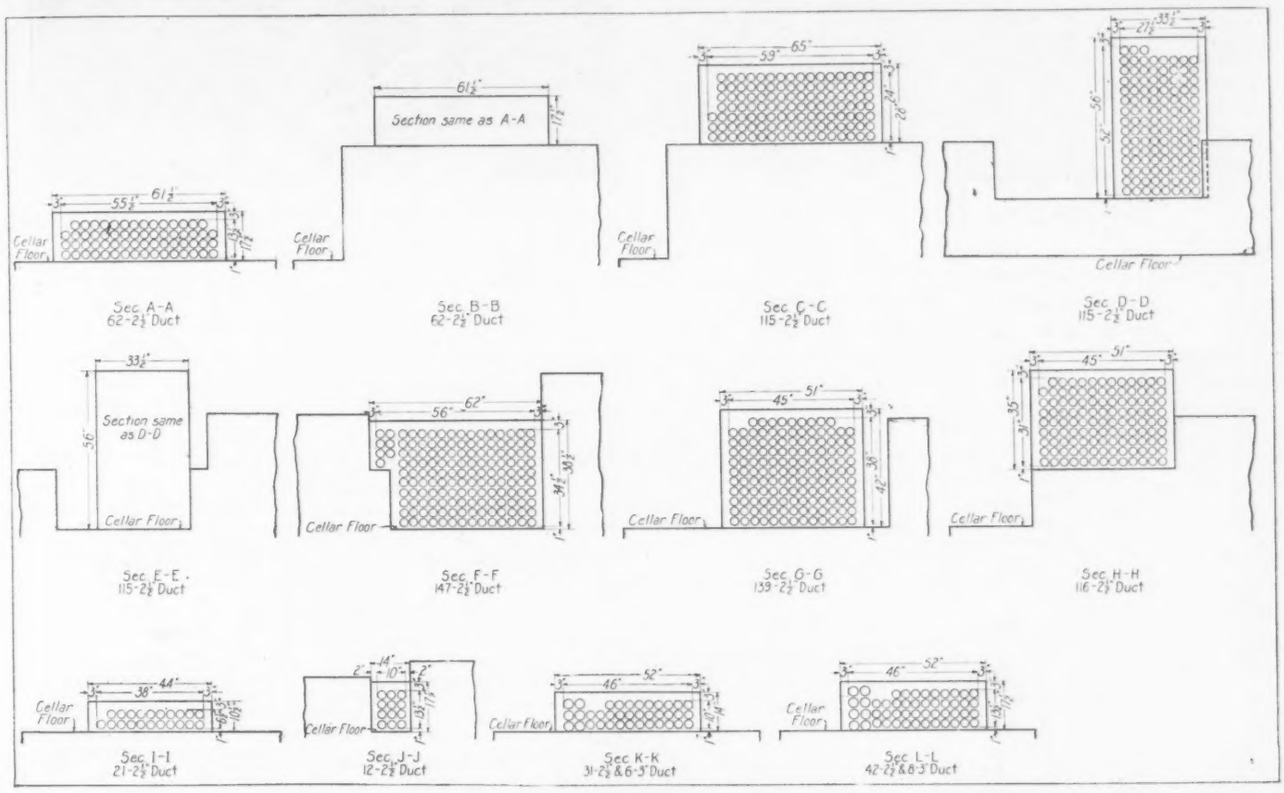


Fig. 46—Sections of Subway.

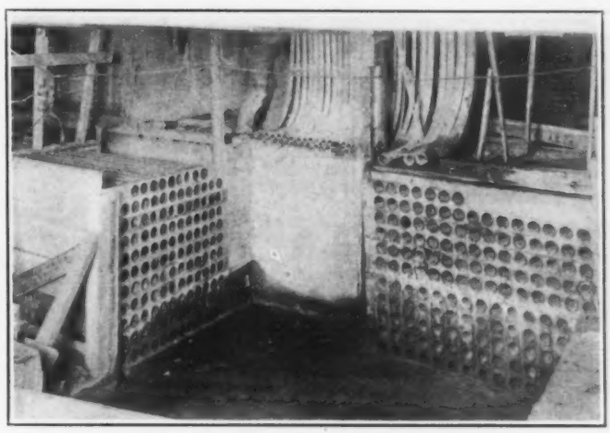


Fig. 47—View of Manhole No. 6. Not Completed.

SUBWAY SYSTEM.

The construction of this subway in the cramped space available and over a surface continually interrupted by

column grillages was no easy task. Detail studies were made of the entire cellar floor and working drawings were prepared with great care so that at no point would free passage through the cellars be obstructed, and to prevent the selection of a route that would be impractical owing to unforeseen space conditions. At many points every available inch was utilized and the cross-section of the subway frequently changes in form, as shown in Fig. 46, to avoid the multiplicity of ducts and pipes. The magnitude of the system may be appreciated from the statement that there are as many as 147 2½-in. ducts in some sections of the subway. The subway was built, as illustrated in Figs. 47 and 48, by setting up the ducts in each section with wooden-end templates made from the cross-section details, after which the outer form walls were built and the whole was flushed with grout. In some cases access to manholes is had from the side, in others through the covers, which in all cases are of flat steel reinforced.

Fig. 48—Detail of Subway Construction.

Conduits to the riser chases are brought down to the manholes and built into the side walls, as shown in Fig. 47, which is a view of the site of manhole No. 6 (see Fig. 9) before the side walls were built. Fig. 50 shows this same manhole completed. The sheet-metal box appearing in this cut contains the Public Service lines passing through this particular manhole. Cables are racked in all manholes in the manner indicated.

The conduit extensions from manhole No. 12 to the Public Service switchboard are shown in Fig. 49. This board, which is shown in Fig. 51, is believed to be one of the handsomest switchboards ever built, the marble being white Vermont statuary with a finish identical with that used on the control board in the Prudential plant. The board stands in the Public Service Corporation's display-room and forms a part of the permanent electrical exposition maintained in this building. It is divided into two sections, one for the alternating-current lighting service fed by three 100-kw transformers located in a vault under the sidewalk, and a motor-service section controlling elevators, fans and other machinery.

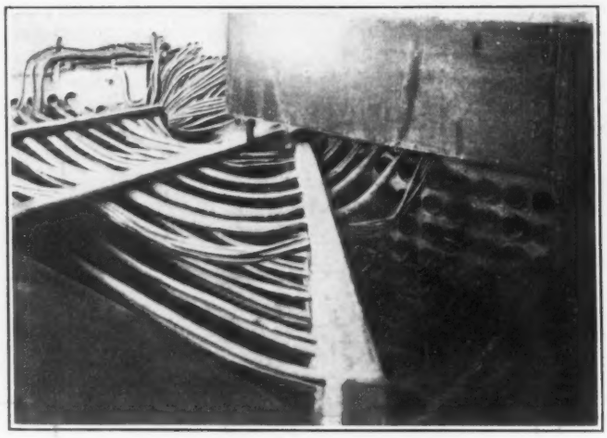


Fig. 50—Manhole No. 6. Completed.

VERTICAL CHASES.

There are five vertical riser chases in the new building, two in the Public Service portion and three in the Prudential portion. These chases were originally intended to be open chases with grille platforms on each floor level, access to the shafts being obtained through doors on each floor. However, final space conditions did not permit such an ideal arrangement and the grilles were not used, access to the shafts being obtained through manholes in the panelboards with the single exception of shaft C, where a door was used.

The general diagrammatic arrangement of the riser system is indicated in Figs. 53 and 54. The former shows the three shafts in the Prudential portion and also indicates the connections to the second and third floors occupied by the Public Service Corporation. The latter shows the two shafts in the Public Service portion. The riser system is in each case divided into three sections for general lighting, hall lighting and night lighting. The feeders for general lighting usually run to two or three floors, the feeders terminating at one panel, the other panels fed by this feeder being connected to the feeder terminal by loop mains of the same size as the feeder. This arrangement avoids the use of feeder fuses except at the sub-switchboards.

The hall and night feeders run to the lowest panel in the riser and loop through from panel to panel, one-size conductor being used throughout to avoid fuses in the

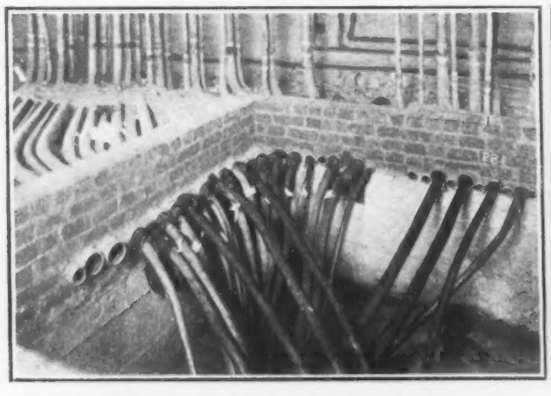


Fig. 49—Manhole Under Switchboard No. 2.

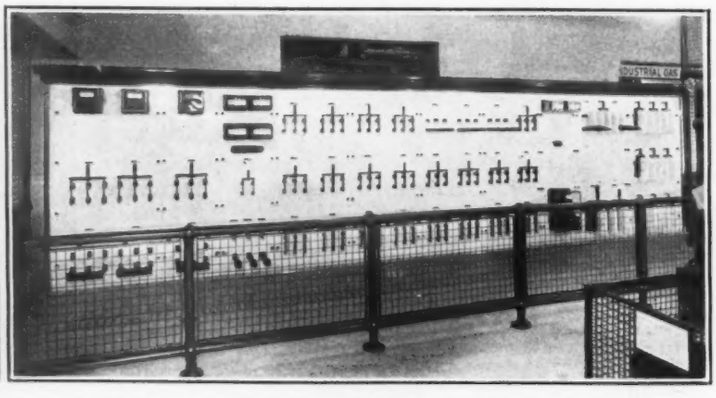
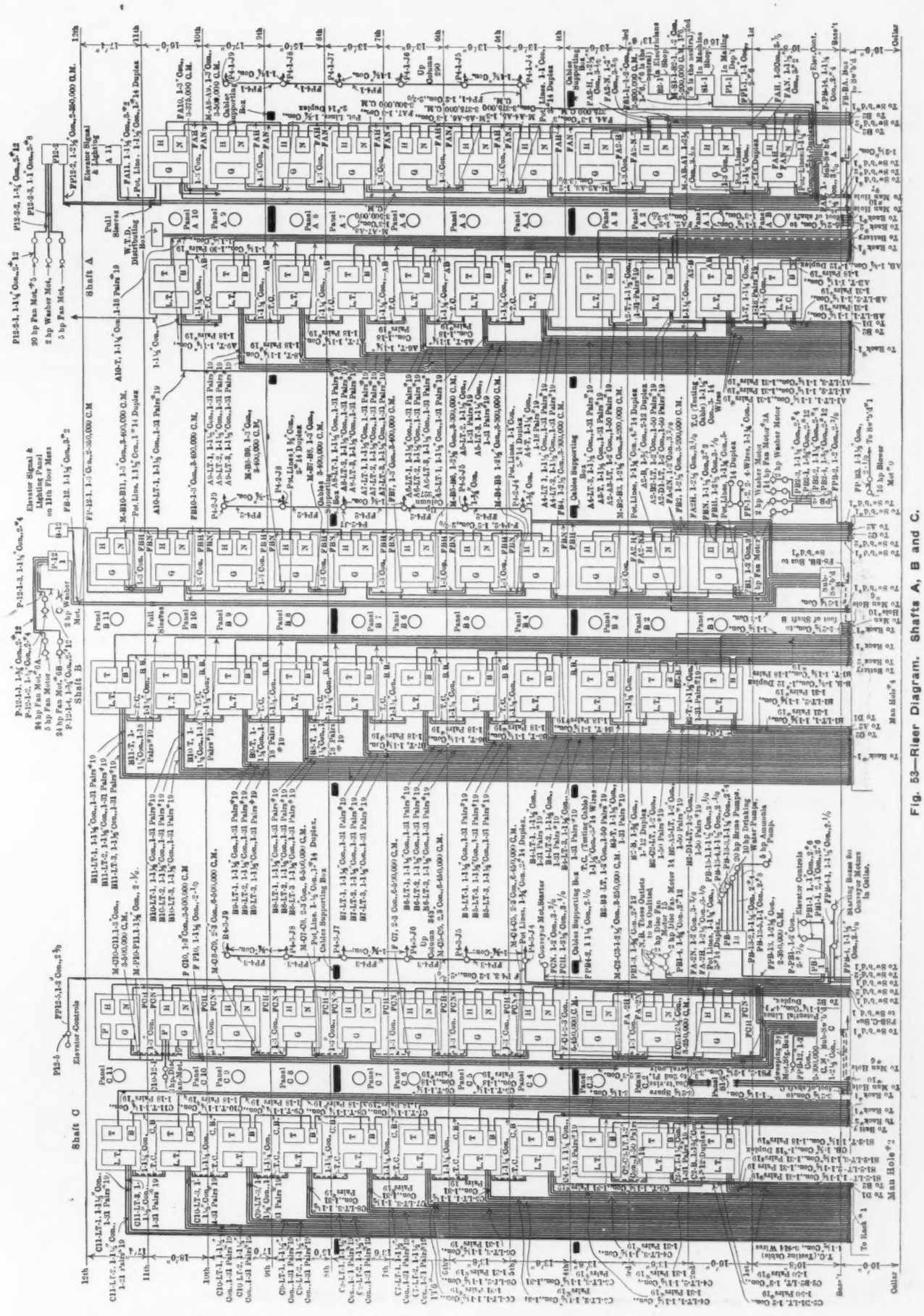


Fig. 51—Switchboard No. 2.


Shaft A
Shaft B
Shaft C
Elevator Signal & Lighting Panel on 11th Floor Mezz
Elevator Signal & Lighting
Elevator Controls
Pull Sheaves
W.T.D. Distributing Box
Cables Supporting Box
Man Hole
To Roof
To Basement
To Battery
To Blower
To Fan Motor
To Washer Motor
To Elev. Cont.
To Sprinkler
To Boiler
Pot Lines, 1-14 Duplex
Pot Lines, 1-18 Pairs
Pot Lines, 1-31 Pairs
Pot Lines, 1-50 Pairs
Pot Lines, 4-Wires
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Pot Lines, 2-Wires
Pot Lines, 1-Wire
Pot Lines, 1-12 Duplex
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Pot Lines, 1-32 Duplex
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panels. All hall and night lamps in each system are thus fed with energy from the main centers of distribution independently of all other lights and are controlled at the main switchboards.

Certain subsidiary risers for small portable motors are run from the sub-switchboards up several of the columns on the outer walls through small cut-out boxes on each floor so that connections may be made as desired to window fans, etc., without going back to the panelboards. Other independent motor-service risers are run from the sub-switchboards to motor panels and motors in several departments where such machines are used. Feeders to the elevator panels in the Public Service portion are run directly to the main service board. Independent feeders are run from sub-switchboards to panels in the elevator machinery rooms, to which are connected all lamps used in connection with the elevators.

The panelboards for lighting service are generally divided into three separately fed sections for general lamps, hall lamps and night lamps, marked G, H and N respectively on the riser diagrams.

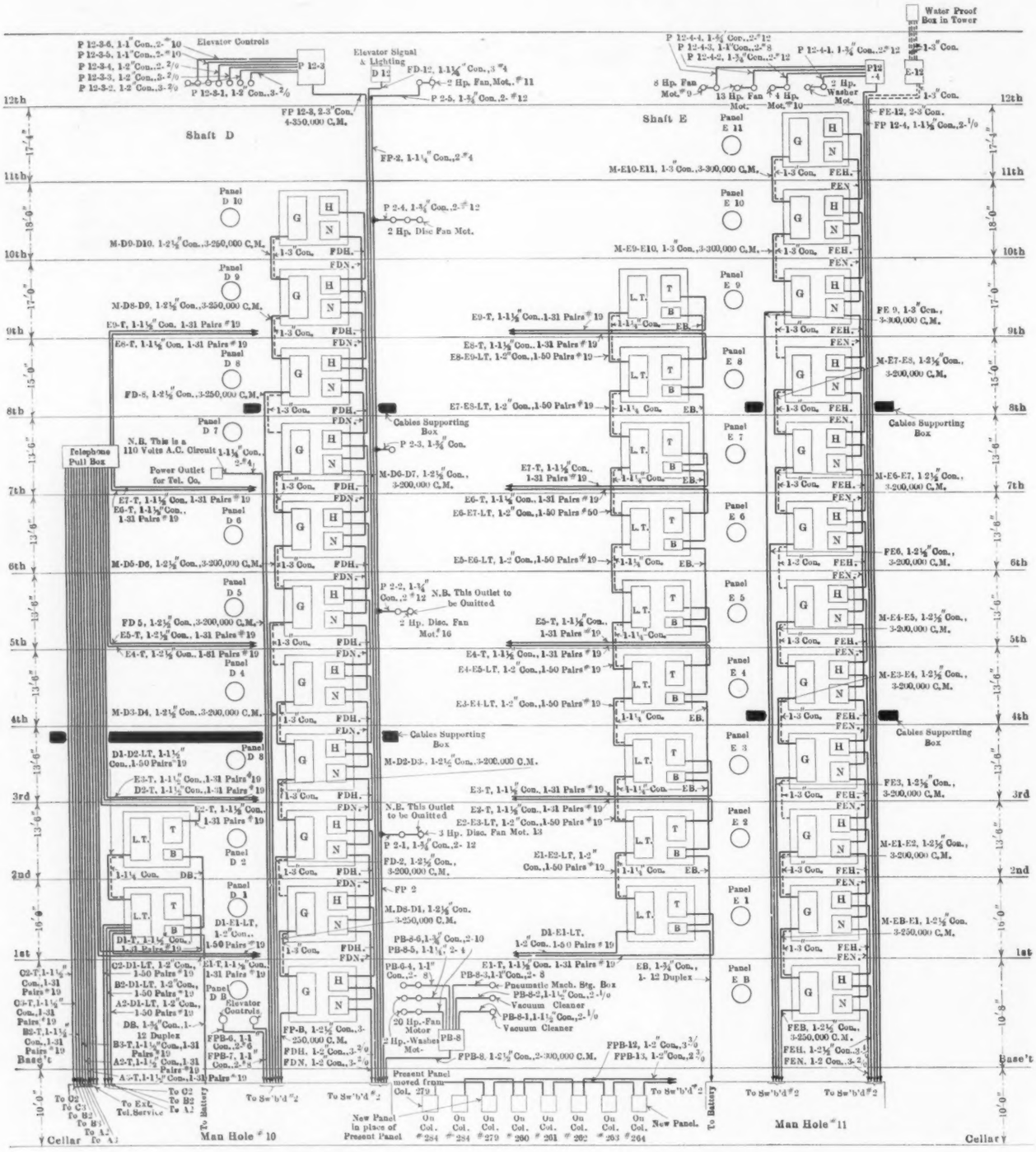
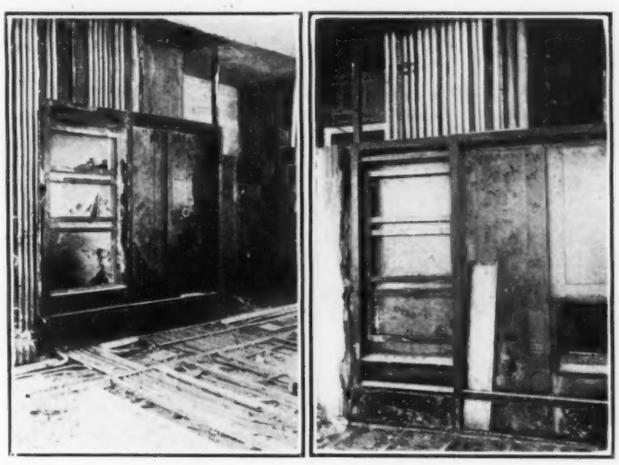


Fig. 54—Riser Diagram. Shafts D and E, Public Service Portion.

In the Prudential portion the panels, being designed to meet the maximum condition as explained above, are in some cases quite large, as many as sixty-six branch-circuit switches being provided in the general section alone. The boxes to contain these panels, together with the low extension compartment, were generally constructed of sheet steel 3/16 in. thick reinforced with angle-iron frames and

corners and corner gusset plates. The boxes extend down to the steelwork framing of the shafts so that the distributing conduits can be brought into the face of the box without turning up. This arrangement provides a pull-space in the lower part of the box which can be exposed by removing the lower portion of the trim and the steel plate behind it. The face of the box is punched to template for the entering branch conduits.



Figs 55 and 56—Panelboard Boxes.

The central portion of each compartment behind each panel slab is removable from the shaft side and the slabs are supported 4 in. clear of the back of the box by cast-iron adjustable supports. By this arrangement it was possible to run branch circuits behind the slabs and thus reduce the width of the gutters since the dimension across the box was generally determined by building conditions.

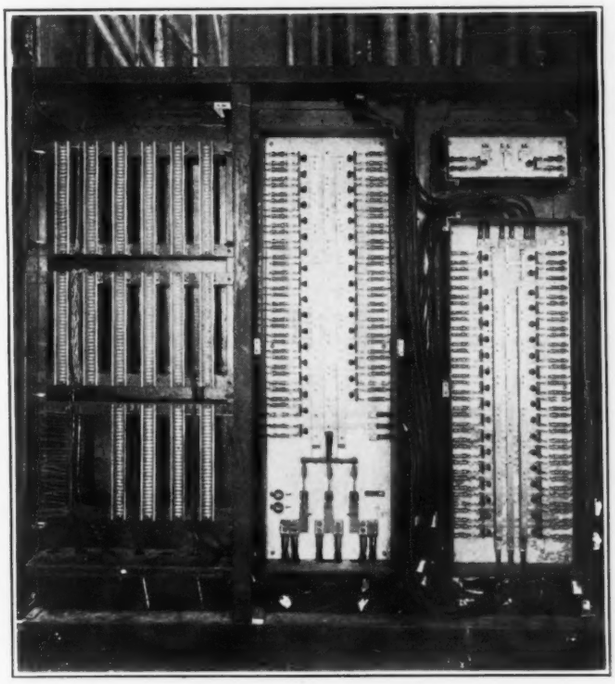


Fig. 57—Panelboard and Main-Floor Junction.

This added depth of the box also caused it to project sufficiently back of the framing beam so that the riser conduits could enter the box bottom without bends or short offsets—a necessary precaution in view of the size of the feeder conductors and the difficulty of bending them in the confined box space.

The opening for the box in the shaft furring is framed by 2.5-in. by 2.5-in. angles, the uprights extending from floor beam to floor beam so that each box is supported independently of the 4-in. terra-cotta blocks.

In Fig. 55 is shown one of the panel boxes set up in its frame before the shaft was walled in. This cut also shows the method of running the branch conduits into the face of the box bottom. In Fig. 56 is shown a box after the floor fill has been put down. This cut also shows the removable base plate and a manhole opening through the box into the shaft. A box with panels mounted and wired is shown in Fig. 57. These panels were built by the General Electric Company.

In some cases in assembly-rooms and dining-rooms, etc., it was desirable to provide for the remote control of panels so that the lamps could be operated together or in groups from single push-button switches.

ARTIFICIAL POWER-TRANSMISSION LINE.

Description of Constructive Details and Results of Tests of a 1500-Mile Single-Phase Artificial Transmission Line Built for Experimental Purposes.

BY A. E. KENNELLY AND H. TABOSSI.

ARTIFICIAL lines for telegraphy have been used for many years.[1] Artificial aerial lines for telephony have also been in use for some time.[2] Artificial aerial lines for power transmission have, however, only recently come into use.[3]

It is intended in what follows to offer a description of a 2400-km (1500-mile), single-phase, or 800-km (500-mile), three-phase, artificial transmission line, constructed after many experimental trials, and now installed as permanent laboratory equipment in the Graduate School of Applied Science at Harvard University.

Artificial lines may be divided into two classes, namely, (1) smooth artificial lines and (2) lumpy artificial lines. In smooth artificial lines the linear constants are uniformly distributed,[4] whereas in lumpy artificial lines the linear constants are inserted alternately in lumps. Smooth artificial lines have the advantage that they behave without change of electrical dimensions to all frequencies alike within a reasonable range; so that surges and transient disturbances may be oscillographed on them in essentially the same manner as they might occur on actual lines. On the other hand, lumpy artificial lines virtually change their electrical dimensions or linear constants with different impressed frequencies, so that they are not well adapted for the study of free oscillations and require to have their electrical dimensions corrected for changes of frequency beyond a certain range. From a mechanically constructive point of view, however, a smooth artificial line is much more difficult to make, and to maintain in good operative condition, than a lumpy artificial line. It is very difficult to maintain the insulation of a smooth artificial line with distributed capacity, owing to the large active condenser surface included within each coil of inductance. Moreover, changes of temperature are apt to disturb the linear constants of a smooth line more than those of a lumpy line. Consequently, while a smooth line is electrically preferably, a lumpy line is mechanically much to be preferred.

[1] C. F. Varley, British Patent 3453 of 1862, and J. B. Stearns, U. S. Patent for duplex telegraphy of 1872.

[2] M. I. Pupin, "Propagation of Long Electrical Waves," *Trans. Am. Inst. El. Engrs.*, March, 1890, Vol. XVI, pp. 93-142.

[3] J. H. Cunningham, "Design, Construction and Test of an Artificial Transmission Line." *Proc. Am. Inst. El. Engrs.*, Jan., 1911, Vol. XXX, No. 1, pp. 87-93. This is described as a smooth or distributed-capacity, single-phase line of 130 miles (209 km) equivalent length of No. 1 B. & S. gage copper wire. $R = 93.6$ ohms, $L = 0.394$ h. $G = 1.135$ μf.

[4] A. and J. Muirhead's artificial submarine cable (British patent of 1375), formed of gridiron plates of tinfoil in paraffin-paper condensers, is a typical smooth artificial line of uniformly distributed resistance and capacitance.

THE IMITATED LINE.

The artificial line here described is of the lumpy type, in sections designed to represent 80 km (49.7 miles) each of No. 000 A. W. G. aluminum stranded conductors, of over-strand diameter 1.195 cm (0.47 in.), suspended parallel to each other, on towers or poles, at an interaxial distance

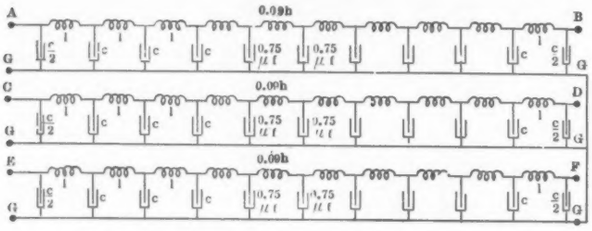


Fig. 1—Diagram of Connections of Artificial Line.

apart of 230 cm (90.5 in.). The normal linear constants of such a line, at low frequencies, are given in Table I.

TYPE OF LINE SECTION.

Lumpy artificial-line sections are of two types, namely, (1) T-sections and (2) π-sections. A line of T-sections—i. e., a T-line—has each section in the form of a T, with its leak or condenser applied in the middle of the line element. A π-line has each section in the form of a π, with a leak or condenser applied at each end of the line element. A complete T-line necessarily presents a half element of line at each end, whereas a complete π-line necessarily presents a half leak, or half condenser, at each end. An artificial line may, therefore, be changed from a T-line to a π-line, or conversely, by a change in the terminal elements only. As originally constructed, the line here described was a T-line, but a change in this respect was found to be convenient, and it is now a π-line, as indicated in the diagram of connections (Fig. 1), where each coil, *l, l, l,* represents the combined resistance and inductance of 80 km (49.7 miles) of wire line, and each condenser, *c, c, c,* the capacity of 80 km (49.7 miles) of wire line; except the end condensers *c/2*, which are of half size, or have only the capacity of 40 km (24.9 miles) of wire line.

CONNECTION OF LINE.

It will be seen in Fig. 1 that each of the three lines *AB, CD, EF* includes ten coils and ten equivalent full condensers, there being nine full condensers and two terminal half condensers in each row. All three lines are supplied by one and the same ground-wire *GG*. Each of the three

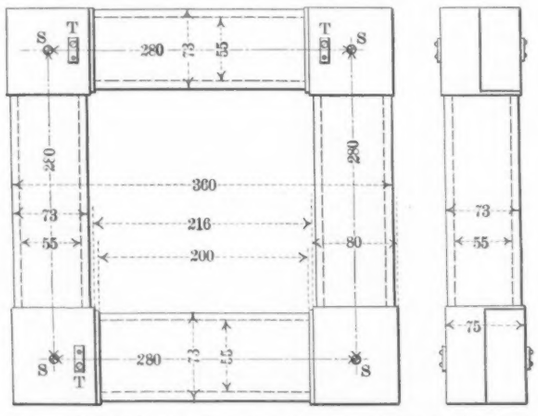


Fig. 2—Outline Sketch of One Coil. Dimensions in Millimeters.

lines thus nominally[6] represents 800 wire-km. (497 wire-miles) of line. By connecting them in a single series, such as *AB-DC-EF*, the total nominal line length becomes 2400 wire-km (1491 wire-miles). By connecting the three lines *AB, CD, EF* in star, with *G* as common neutral, the system becomes a three-phase line of 800 km (497 miles) in nominal length. By connecting up any pair, such as *AB* and *CD*, leaving the ground wire *G* as an unattached neutral, the system becomes a single-phase line of 800 loop-km (497 loop-miles) in nominal length. A single plug piece in each line section, not shown in the diagram of Fig. 1, enables the line to be opened at any section junction, so as to reduce the nominal line length at will by steps of 80 km.

CONSTRUCTION OF COILS.

It is manifestly desirable that the inductance coils forming the line sections should have as little mutual inductive action as possible. That is, they should have the required amounts of self-inductance, but no mutual inductance, if possible. Closed circular solenoids, or anchor-ring coils, if properly wound, would have no external magnetic field and therefore would be devoid of mutual inductive action; but, for mechanical reasons, it is not convenient to adopt the anchor-ring form. A square-frame form was adopted as being a suitable compromise between a mechanical construction easy to wind and a magnetic circuit of the closed type. The outline dimensions of the coils are given, in millimeters, in Fig. 2. It will be seen that each wooden frame coil, or main coil, comprises four symmetrical straight coils. The base diameter of each component coil is 55 mm (2.16 in.) and the interflange length 200 mm (7.88 in.). Each component coil is wound with 1190 turns of double-cotton-covered copper wire, No. 19 A. W. G. of bare diameter 0.915 mm (0.036 in.) and covered diameter 1.14 mm (0.045 in.), occupying approximately seven layers of 170 turns each. The external winding diameter is about 73 mm

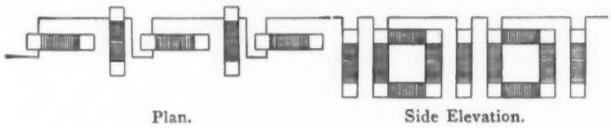


Fig. 3—Plan and Side Elevation of Artificial-Line Coils.

(2.87 in.). After each component coil was wound it was immersed in molten paraffin wax, in order to drive out moisture and preserve the insulation of the winding. Four component coils were then assembled together into a square frame, being fastened by a single stout countersunk brass screw *S, S* at each corner. Each frame or main coil, unwound, weighs 2.8 kg (6.13 lb.) and contains 5.6 kg (12.35 lb.) of insulated wire, or weighs, when wound, 8.4 kg (18.5 lb.) in all. The total weight of insulated copper wire in the entire triple-line system is approximately 168 kg (370 lb.). The average resistance of each coil is 22.2 ohms at 0 deg. C., 23.6 ohms at 15 deg. C. and 24.6 ohms at 25 deg. C., making the total line resistance *AB, CD* or *EF* (Fig. 1) as 222, 236 and 246 ohms, at these three temperatures respectively, and the nominal linear resistance at 0 deg. C. 0.278 ohm per wire-km (0.446 ohm per wire-mile), at 15 deg. C. 0.295 ohm per wire-km (0.475 ohm per wire-mile), and at 25 deg. C. 0.308 ohm per wire-km (0.495 ohm per wire-mile).

The average inductance of each main coil, with its wooden core and frame, is approximately 90 millihenrys, making the total inductance of each of the three lines *AB, CD* or *EF* (Fig. 1) 0.90 henry. This represents a nominal linear inductance of 1.13 millihenrys per wire-km (1.82 millihenrys per wire-mile).

ARRANGEMENT OF COILS.

Owing to the plan of constructing the coils in the form of squared anchor rings, their external magnetic flux is relatively feeble. Nevertheless, in order to minimize the mutual inductive action of adjacent coils, those of each line are mounted, on a shelf, in vertical planes alternately perpendicular to one another. That is, the even-numbered main coils are parallel and likewise the odd-numbered coils, but the even numbers are all perpendicular to the odd numbers, as indicated in Fig. 3, which shows in plan and in side

[6] A nominal length is a length uncorrected for the lumpiness of the line.

elevation the spacing and connection of the ten main coils forming one of the three main lines. In this way the assemblage of coils in the system is made more compact, while the mutual inductive disturbance at ordinary frequencies becomes negligible. A picture of the entire set of three lines, in a sliding glass-door case, is shown in Fig. 4.

TABLE I.—NORMAL LINEAR CONSTANTS OF ARTIFICIAL LINE AT LOW FREQUENCIES.

	Per Wire-Km.	Per Wire-Mile.	Per Loop-Km.	Per Loop-Mile.
Linear resistance:				
At 0 deg. C. (32 deg. Fahr.), ohm.	0.304	0.489	0.608	0.978
At 15 deg. C. (59 deg. Fahr.), ohm.	0.322	0.518	0.644	1.036
At 25 deg. C. (77 deg. Fahr.), ohm.	0.334	0.537	0.668	1.094
Linear inductance (l), millihenrys	1.24	1.995	2.48	3.99
Linear capacitance (c), millimicrofarads	9.32	15	4.66	7.5
Linear leakance (g), mho	0	....	....	....

CONDENSERS.

The condensers are composed of tinfoil and paraffin paper and have been obtained from several manufacturers at different times. Each full condenser averages 0.75 microfarad, or 9.375 millimicrofarads per wire-km (15.1 millimicrofarads per wire-mile). Each condenser is set in a tinned iron box 20 cm by 5.6 cm wide by 14.2 cm high (7.9 in. by 2.2 in. wide by 5.6 in. high), the space between the box and the condenser being filled up with paraffin wax. These condensers have a small but definite power loss at a given voltage and frequency, corresponding to a certain small nominal linear leakance in the line.

NOMINAL LINEAR CONSTANTS OF THE CONSTRUCTED ARTIFICIAL LINE.

The nominal average linear constants of the line are given in Table II.

The correction factor of the line-angle subtended by a half section is known to be $\theta/\sinh\theta$, where θ is the apparent hyperbolic angle subtended by the half section.[6] The correction factor in this case becomes 0.07 per cent for the frequency of 60 cycles; or the actual hyperbolic angle subtended by the section is greater than the nominal hyperbolic

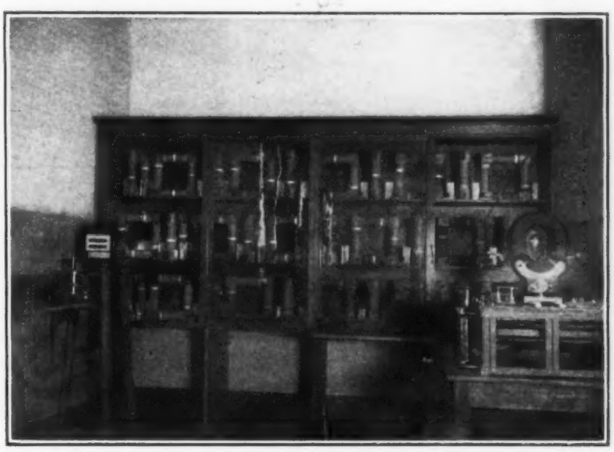


Fig. 4—Face View of Complete Artificial Line and Auxiliary Apparatus.

angle by this negligibly small amount. In other words, the lumpy artificial line behaves, for all practical purposes, like its corresponding nominal smooth line, in the steady alternating-current state, at this frequency. As the frequency is increased the correcting-factor increases and cannot be neglected, with this line, at frequencies higher than 200 cycles.

METHOD OF TESTING THE ARTIFICIAL LINE.

The ordinary method of testing a given length of the artificial line has been to apply at the generating end a measured emf, as nearly sinusoidal as possible, and at a carefully measured frequency, while an assigned load is applied at the receiving end of the line under test. The potential difference to the ground wire $G\,G$ (Fig. 1) was then measured at different points along the line by means of a Kelvin electrostatic voltmeter. The condensers have all been tested for dielectric strength up to 500 volts (root mean square); but care has to be taken that this potential difference is not exceeded, since, at a frequency of about 330 cycles, a resonant rise of voltage of over tenfold was observed on this line. The current strengths at successive junction points along the line are also observed when inserting a split-plug connector into the junction plug pieces,

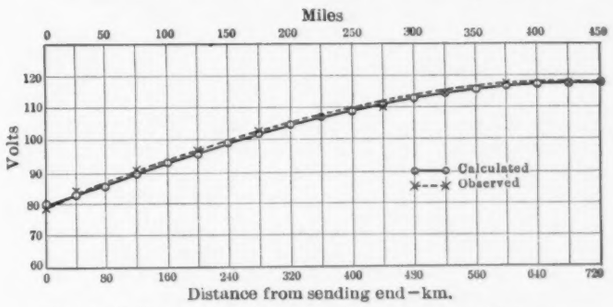


Fig. 5—Voltage Along the Artificial T-Line at 60 Cycles.

TABLE II.—NOMINAL LINEAR CONSTANTS OF ARTIFICIAL LINE.

	Per Wire-Km.	Per Wire-Mile.
Linear resistance:		
At 0 deg. C., ohm	0.278	0.445
At 15 deg. C., ohm	0.295	0.473
At 25 deg. C., ohm	0.308	0.495
Linear inductance (l), millihenrys	1.13	1.82
Linear capacitance (c), millimicrofarads	9.38	15.1
Linear leakance (g), micromho	0.15	0.24

Linear hyperbolic angle $= 0.00136\ \underline{/71.5}$ deg. hyp. per km.
$= 0.00218\ \underline{/71.5}$ deg. hyp. per mile.

Nominal hyperbolic angle subtended by one section of artificial line at 60 cycles $= 0.108\ \underline{/71.5}$ deg. hyp.

Nominal hyperbolic angle subtended by one-half section of artificial line at 60 cycles $= 0.054\ \underline{/71.5}$ deg. hyp.

Correction factor for lumpiness at 60 cycles $= 1.0007\ \underline{\backslash 0.03}$ deg.

which are visible in the illustration, Fig. 4. The series of observations thus obtained are then readily capable of being checked by computation. An example of the results of such a series of observations is presented in Fig. 5, over a single-phase T-line of nine sections, representing 720 km (447 miles), at the frequency of 60 cycles, with the distant end of the line free. The broken curve represents the observed potential difference along the line at successive section junctions, while the unbroken curve represents the graph of the corresponding computed values. It will be seen that the two curves agree satisfactorily, and that the voltage at the distant free end of the line was about 48 per cent in excess of that at the generator end, representing a Ferranti-effect multiplier of 1.48. Great care must be exercised in keeping the frequency constant and the impressed emf wave pure, in order to obtain consistent series of such observations.

In general, the various tests thus far made with the line have demonstrated the reliability of the hyperbolic theory of artificial lines.

[6] "Artificial Lines for Continuous Currents in the Steady State," by A. E. Kennelly, *Proc. Am. Ac. of Arts and Sc.*, Vol. XLIV, No. 4, pp. 97-130, Aug. 26, 1908, and "The Application of Hyperbolic Functions to Electrical Engineering Problems," by A. E. Kennelly, *The University of London Press*, 1911, Chapter III.

Central Station
Management, Policies and Commercial Methods

ELECTRIC POWER FOR WOODWORKING.

The Louisville Lighting Company is cultivating the extensive woodworking interests in Louisville, Ky. Recently it installed a motor equipment for the Norman Woodworking Company, each machine being operated by an individual motor. The woodworking plant of the Norman company is arranged in units, each unit consisting of a re-saw, a planer and an edger. Through this method the greatest possible output is gained with a minimum amount of labor expended in handling materials.

A planer, a re-saw and an edger are placed in a straight line, and consequently practically no re-handling of material from one step of manufacture to the other is necessary. Thus far the mill has paid the electric-power bill with the proceeds from the sale of the plant's waste. This fact constitutes a prime feature in the advantages of electric drive for a woodworking factory; and, inasmuch as the Norman cost of operation is in direct proportion to the output, the balance of power cost with returns from the sale of waste promises to be maintained constantly.

ELECTRICAL WIRING AND THE CONTRACTOR.

Electric wiring construction aggregating in value $10,000,000 is done each year in the United States, according to Mr. J. T. Marron, Rock Island, Ill., who discussed the status of the contractor in the electrical industry in an address before the Electrical Contractors' Association of Illinois at Chicago on Feb. 3. Of this $10,000,000 worth of construction, about $2,000,000 is done by curbstone wiremen, $1,500,000 by the owners themselves, and the rest by the established professional electrical contractors. Even half of this last work, insisted Mr. Marron, the contractors carry out at a price below the cost, when the items of labor and legitimate overhead expense are figured in. Thus 70 per cent of the electrical work done in this country each year is without profit to the contractor, declared the speaker.

Most electrical contractors, having risen from the ranks of the wiremen, lack business education and experience and do not understand how to compute the cost of carrying on their businesses. The result of this is seen in the small attraction electrical contracting offers to business men from other fields, as well as in the great number of failures among electrical contracting firms. No less than 65 per cent of such firms in business during the last twenty years ultimately wound up in disaster. These contractors lacked a realization of the heavy cost of running their businesses. For example, the "overhead" in a wiring business of $10,000 a year has been found to amount to 40 per cent; $20,000, 28 per cent; $30,000, 23 per cent; $50,000, 22 per cent; $75,000, 20 per cent, and $100,000, 17 per cent.

CO-OPERATING WITH MUNICIPALITIES.

Addressing the Grand Forks (N. D.) Commercial Club recently Mr. R. G. Hunt, assistant to Vice-president Huey, of H. M. Byllesby & Company, voiced the modern spirit of co-operation between municipalities and public-service corporations. The Red River Power Company, of Grand Forks, is one of the Byllesby properties, and Mr. Hunt dwelt on the attitude of the public toward utility companies. In the course of his speech he said:

"We saw the need of a broad and liberal policy if we were to grow and succeed. It is needless for me to tell you of our lively interest in this community and every other where our interests lie. We offer you freely our brains, our muscle and our financial assistance toward the greatest possible development of this your city and ours. We have a pardonable, selfish interest in hoping for the sale of more electricity and more gas than we now sell, just as you hope to sell more groceries, more dry goods, more tobacco and more furniture. Our dream is to sell every unit of power and every candle-power of light used in this city. Produced under one roof it can be made cheaper and sold cheaper than under a hundred roofs. You have the same dream to produce more and sell more. The shortest path to a realization of your dream and ours is co-operation, forgetting petty jealousies and personal enmities, all uniting in purpose and combining our efforts toward a greater and better city, countenancing nothing that disrupts and fostering the spirit that builds empires."

THE LIGHT THAT FAILED.

Like vanquished soldiers fallen before the victorious army of electrical progress, the gasoline lighting installations at Fargo, N. D., are one by one being supplanted by

Dismantled Gasoline Lighting Plant.

tungsten lamps in the campaign now being waged by the Consumers' Power Company against competitive illuminants. The collection of tin cans and speaking tubes shown in the accompanying illustration represents all that is left of the gasoline lighting plant which formerly illuminated the Coleman Toggery Shop at Fargo. There were seven single-burner fixtures, but these have now been replaced by modern, safe and sanitary illumination furnished by five 100-watt tungsten lamps. The customer, of course, is well pleased with the change.

THE ELECTRIC VEHICLE IN DENVER.

The Denver Gas & Electric Company has begun the publication of a handsome monthly periodical called *The Electric Vehicle*, the first number of which is dated January. This issue contains an account in detail of the electric-

vehicle service of the Denver Gas & Electric Company, which purchased its first electric truck three years ago and has now twelve trucks in use. In changing from horse to electric service it was found that the drivers could take charge of an electric truck after only a few days' instruction. The vehicles now in service include four 3½-ton trucks, one 2-ton truck, four 1000-lb. trucks and three 700-lb. trucks. The company contemplates ordering two additional trucks in the immediate future, and possibly other additions will also soon be made.

Tables are given of the relative cost of horse and electric traction, based upon the experience of the company. A comparison between the operating cost of a 1000-lb. truck and a one-horse wagon employed in the same service shows a total cost for the former of $105.07 per month and for the latter of $94.16, but the electric truck accomplished 70 per cent more work. In another case the total cost per month of operating a 1000-lb. electric truck was $216.30, and that of a one-horse wagon in the same service $213.75, in each case the wages of two men engaged in meter work being included. While the figures show 1¼ per cent increase in cost of operation for the electric truck, the latter did 21.9 per cent more work. In delivering coke the saving by using electric trucks is at present 40 per cent over horses, and this saving, it is stated, will be materially increased by the use of electric trucks having a carrying capacity of 2 tons for the delivery of 1-ton and 2-ton orders. On the basis of a delivery of 3600 tons per year, two 3-ton machines showed a saving of $3,240 annually over horse haulage. Among the incidental advantages of electric over horse traction has been that the former enabled the company to centralize its hauling equipment and very largely decrease its fire risk.

RATE WAR IN LOUISVILLE.

A rate war has been declared between the two leading electric companies of Louisville, Ky., the Louisville Lighting Company and the Kentucky Electric Company. At a joint meeting of the directors of the Louisville Lighting Company and the Louisville Gas Company some days ago it was decided to lower the electrical rates of the company from 10 cents to 8 cents per kw-hr., the reduction being applicable only in the residential districts of Louisville. The vote in favor of the move to cut rates was unanimous at the joint session of the directors.

The reduction of 2 cents per kw-hr. will mean a saving of at least $29,000 to the present customers of the lighting company. The earnings of the company last year approximated $146,000, and the cut reduces this figure 20 per cent.

"The merger which has been pending in Louisville electrical circles for the past two years was quashed permanently last week when our directors voted a reduction in rates and now it is a question of war with competitors," said A. T. MacDonald, general sales manager of the Louisville Lighting Company. "We are satisfied in our stand and while there are debatable points in the conflict the case is being put before the public for its decision through the medium of newspaper advertisements."

The Kentucky Electric Company is outlining its arguments in the newspapers, and the following is an extract from one of its advertisements, which appears under the head "The Public Won't Be Fooled":

"The Kentucky Electric Company has forced the Louisville Lighting Company to creep a little farther out of its shell of high rates for electricity, but it must come clear out in the open space of modern rates to be able to get a glimpse of the Kentucky Electric Company passing under the wire of public approval.

"The 'old' company announces from Feb. 1, 1912, a reduction in the price of lighting energy from 10 cents net per kw-hr. to 80 cents net. The 'new' company—the Kentucky Electric—has had in effect since Feb. 1, 1908, the day it began soliciting business for the inaugural operation of its plant, seven months later, a rate far below 8 cents per kw-hr. This 'Ky-El-Co' rate was a two-step rate which has been in effect ever since, and has done more to popularize the extended use of electricity in Louisville than all combined acts of the 'old' company during its lifetime.

"The 'old' company's half-in-two cut in rate the day the Kentucky Electric Company began operating its first plant, on Sept. 1, 1908, was done with the hope of putting us out of business, but we have thrived on its attempts at destruction, and on Feb. 1 will start a new plant with three times the capacity of our first one.

"Nine hundred and twenty-two of its customers have contracted with us since New Year's Day, about three weeks ago, to take our service. Our offices receive six to eight petitions daily to extend our lines—Crescent Hill, Clifton, the Highlands, Southeast Louisville, Southwest Louisville, down Broadway, Portland, Parkland—all sections want us.

"Three carloads of copper wire are now being received; twenty carloads of poles en route and the right to use every Home Telephone pole in the city will prove our good faith in the matter of making extensions.

"KENTUCKY ELECTRIC COMPANY,
"By R. E. Hughes, President."

The advertisements lay stress upon the local ownership of the Kentucky Electric Company. That company has just entered into a contract with the Louisville Home Telephone Company for joint use of the poles of the latter, which serves 10,000 subscribers.

SHALL THE CENTRAL STATION DO A WIRING BUSINESS?

The small central station is often "up against" the problem of doing its own wiring for customers or not having that wiring properly done at a fair price. This ever-recurring dilemma was discussed at length at the recent convention of the Wisconsin Electrical Association, when several managers expressed their opinions, offering arguments on both sides of the question. The discussion followed a paper by Mr. W. B. Voth, of Sheboygan, Wis., in which Mr. Voth had urged central stations to leave to the contractors their own specialized business.

Mr. P. H. Korst, of Janesville, Wis., said that in the majority of towns of 5000 and under there is room for but one contractor. Where several contractors are located in a city or town the advent of an active and aggressive man, or the central station itself, into the wiring and supply business, will act to stir up the others. Properly considered, added Mr. Korst, the contractor may become a source of much profit to the central station. Taking this view in his own city of Janesville, Mr. Korst's company remained out of the wiring business for five years, but was forced to come back into it at the end of this time, in order to get its customers properly served. Mr. J. S. Allen, of Lake Geneva, Wis., insisted that the central station is not a merchant and cannot equitably handle the supply and wiring business. His own company, he said, does not offer even a lamp for sale, purchasing all its supplies from local contractors. Mr. H. C. Sterling, of Three Rivers, Mich., said he felt that central stations can do such business to better advantage than the contractor and explained that his own company's supply department operates on a 10 per cent basis. Mr. Edward Daniel, of Marinette, Wis., declared that wiring has become a proper part of the electric company's duties, being necessary to the sale of energy and the encouragement of business. Mr. I. P. Lord, Waupaca, reported that in his town of 3000 population the central station does wiring and sells supplies.

BALTIMORE'S "HOUSE ELECTRIC."

Baltimore, Md., in character, is unique as an American city because of the large number of homes in proportion to the population, there being 100,000 dwellings for a popula-

to set aside so much a week with his particular building association to be applied to the purchase price.

The Consolidated Gas, Electric Light & Power Company is serving with electricity at present about 10 per cent of the homes in Baltimore, there being approximately only

Interior Views of "House Electric" in Baltimore.

tion of about 600,000. The majority of the occupants of ıese houses either own them or are purchasing them rough numerous building associations. A large number small two-story houses (over 50,000), selling from o to $2,500, makes it possible for the small wage earner

10,000 homes wired and equipped for service. The interest of the company, therefore, lies in popularizing the use of convenient energy-consuming devices in the homes and placing before the public a simple and economical plan for obtaining these devices. With this end in view, wiring

campaigns were instituted covering two distinct classes of wiring, the concealed knob and tube method for the better classes of homes and the wooden-molding method for two-story houses, wiring orders being taken through lease contracts calling for twelve monthly payments to be made with payments covering bills for energy consumed.

These two campaigns have proved very successful and have led to a much more comprehensive interest in things electrical on the part of the public than existed before. In response to this interest, the company decided to offer for sale on the same deferred-payment plan and in comfortable surroundings the most modern and carefully selected variety of electrical devices suitable for home use.

The "House Electric" was then established in a three-story building centrally located on the best class retail street in the city, the building having formerly been a large residence. The interior was so changed that the commercial feature of the average high-class shop was softened to such a degree as to convey the impression to a visitor that every care had been taken for his or her comfort while a guest of the company. The furnishings of the various rooms were selected with more thought for the comfort of the public than for emphasizing the sales element in the function of the place. The lighting fixtures that are on display were selected with regard not only for their light efficiency but also for their furnishing value. A room was equipped as a lounging-room for ladies, with all of the accessories which might tend to their comfort while visiting the house or while on a shopping tour in the immediate vicinity. Free telephone service is furnished, as well as stationery and other minor things. Tea is served in the lounging-room every afternoon, and a cordial invitation has been issued to the public at large to partake of the company's hospitality.

From the appreciation that has been unanimously expressed by the visitors to the "House Electric" so far, the company feels that it has been successful in accomplishing three fundamental purposes for which the house was created, namely: To place at the service of its customers a cheerful and homelike shop where business can be transacted with the least amount of inconvenience to them; to place prominently before the public suitable demonstrations of energy-consuming devices in an environment the same as they might be purchased to operate in; to offer for sale at reasonable prices and on easy terms every efficient electrical device which would add to home comfort.

Wiring of houses is considered purely as an auxiliary, and the company has been guided to a large extent in its merchandising policy by treating the "wiring for" a given fixture or device as a part of the sale of that particular fixture or device. The "House Electric" is located at 325 North Charles Street, Baltimore, and is in direct charge of Mr. C. E. Robertson, who also manages the wiring department recently established by the company. Interior views shown herewith give a very good idea of the excellent taste manifested in furnishing and decorating the house, and the hospitality extended by attendants is in keeping with the warmth and cheerfulness of the decorations.

Wiring and Illumination.

A POLE-TOP ELECTRIC SIGN.

In many places an electric sign can be erected to advantage where there is no building to furnish support. In fact, signs in such positions may be even more conspicuous than any others, owing to their black, blank background without light sources from other illuminants to detract from their brightness. The accompanying illustration shows a large electric sign erected on two poles in the border of the residential district of Fort Smith, Ark. This sign contains 262 5-watt, 4-cp tungsten sign lamps. A steel frame was erected between the poles, as shown, and all wiring is in conduit. The sign flasher is contained in the box on the left-hand pole and can be readily inspected with the aid of a pair of climbers. A patrolman on his

A Pole-Top Electric Sign.

rounds lights and extinguishes the sign by means of a switch at the street level, which completes the main circuit through a conduit extension down the left-hand pole.

In the background is shown a signboard lighted by flaming-arc lamps. This has also been found to be an effective means of advertising in Fort Smith.

SPECIAL ENERGY DISTRIBUTION OF NEON AND HELIUM.

By W. W. Coblentz.

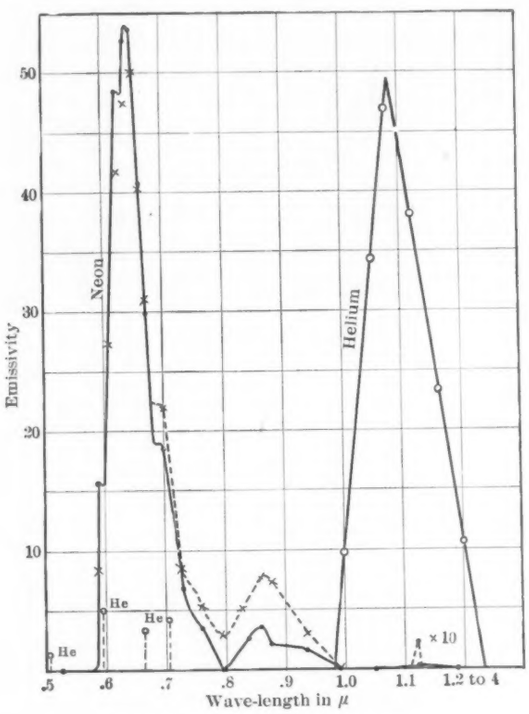
It is becoming more and more apparent that a further increase in the luminous efficiency of our light sources will come about through the development of gaseous radiators. "Selective emission" is recognized as the method that will perform the trick, but the substance has not yet been found. It is recognized that the energy put in must come out again in some form, mostly as radiant energy, and it is desirable for as much as possible of these radiations to be of a frequency that affects the eye.

Owing to the high reflecting power in the infra-red and an unusually low reflecting power in the visible spectrum, the refractory metals, such as tungsten, have been one milestone in the path of progress to a more efficient illumination by selective emission. But it was only a short step forward, for the metals are not sufficiently refractory to withstand the high temperatures demanded to shift the maximum emission into the visible spectrum.

The utilization of the selective emission of certain incandescent oxides is another recognized method for the production of luminous radiations. In the form of a gas mantle they perform fairly well. Here the radiation is not a function of the surface condition of the material, but of the thickness of the radiating layer. In the gas mantle the small particles of colored oxide easily attain the tem-

perature of the bunsen flame—which is about 1800 deg. C. The smallness of the radiating particles produces a high emission in the visible spectrum in comparison with the emission in the infra-red. In a solid—electrically heated—glower conditions are reversed, for the thick radiating layer contributes a far greater amount of infra-red radiation in comparison with the emission in the visible spectrum than obtains in the gas mantle, and the operating temperature is not much higher—from 200 deg. to 300 deg.—in the glower than in the mantle. Furthermore, with rise in temperature the discontinuous emission spectrum in this form of radiator becomes more continuous and approaches that of a black body. Hence, even though a more refractory oxide be found in the "rare earths," the luminous efficiency will not be markedly increased by operating it at a higher temperature than obtains at present owing to the increased emission in the infra-red as a result of a nearer approach to a black-body emission.

The data available on vacuum tube radiation are not very extensive, and hence any progress made in this method



Emissivity of Neon and Helium.

of illumination is of interest. In the vacuum-tube radiation from carbon dioxide or nitrogen—Moore tube—there is a considerable emission of infra-red, which lowers the luminous efficiency.

The recent addition of the Claude[1] neon tube to the list of vacuum-tube illuminants is a noteworthy event. He seems to be conserving the natural resources by utilizing the by-product obtained from the manufacture of liquid air, which as an illuminant gives a specific output (2.5 candles per watt) that is sufficiently marked for one to inquire into the emissive properties of this gas. That the emissive properties of this gas are extraordinary is shown below.

In a previous publication[2] the present writer gave the spectral energy distributions of various gases—nitrogen, CO_2, etc.—in vacuum tubes, and of metals in the carbon arc. The main object of the investigation was to determine the location of the strongest emission lines in the spectrum. It was found that the most intense lines lie just beyond the red—in the region from 0.8μ to 1.0μ—and that in the region of 1.5μ to 3.5μ there was a complex radiation, which was weak in intensity and, usually, unresolved with the spectrometric apparatus employed. Subsequent experimenters using a larger dispersion have succeeded in resolving this latter region into separate lines which, in their spectral series relation, are found to be a continuation of the lines in the visible spectrum. The dispersion of the present spectrobolometric apparatus—mirror spectrometer, fluorite prism and vacuum bolometer—was not sufficient to enable one to locate the individual lines. However, a vacuum tube containing neon being available, it was deemed of interest to continue the inquiry as to the location of the most intense emission lines. At the present stage of our knowlege of the subject very little can be said of the application of these data. The whole may be summarized by stating that in spark spectra the most intense lines are situated in the ultra-violet; that in the arc and vacuum-tube spectra the most intense lines are situated just beyond the red, and that in solids the maximum emission lies far in the infra-red, but shifts rapidly toward the visible range with rise in temperature.

The spectrum of neon consists of numerous fine lines, the most prominent group in the red not being resolved by the fluorite prism. The prismatic spectral energy curve (dotted) and the normal curve—obtained by treating the unresolved lines as a continuous spectrum—of neon are shown herewith, from which it may be noticed that the maximum emission lies within the group of lines in the red. The intensity of the line or group of lines in the region of 0.85μ is only about one-twentieth that of the red. A slight emission was observed for 1.12μ. Beyond this point no radiation was observed for the current—0.008 amp—capillary tube 1 mm in diameter—at which the tube was operated. No doubt more lines will be observed on a more intense excitation; but this will not modify the observations as to the location of the maximum emission. From the data at hand it appears that the maximum emission in the region of 0.62μ to 0.65μ is not due to the lack of resolution of a group of lines, as compared with the maximum at 0.85μ, but it is a property of this gas. This appears to be the only gas on record in which this property obtains.

The spectrum of helium consists of fewer lines than neon, the most prominent one being the yellow line at 0.5876μ. Examined with a radiometer, however, conditions are found quite different. The red lines are then found to be as intense as the yellow line. The most intense line lies at 1.083μ, as shown herewith. The intensity of another (weak) line at 2.05μ is only 0.05, and the yellow line is only 0.1 the value of the line at 1.083μ.

It is well known that only a small fraction of the energy expended in such gases as helium, xenon, etc., is required to excite neon to light emission. Since the energy put into the gas must come out again in some manner—mostly as radiation of various lengths—and since very little of the radiation emitted by neon is in the infra-red, an explanation is at hand as to the small energy input (high efficiency) required to excite this gas to light emission.

The luminous efficiency of vacuum-tube radiation, air[3], nitrogen, carbon dioxide, helium, etc., is of the order of from 15 to 20 per cent, or perhaps even much lower, owing to the great amount of infra-red radiation emitted. In marked contrast with these gases is neon, in which the infra-red is almost entirely absent so that its luminous efficiency is of the order of from 80 to 90 per cent (estimated), while the efficiency of helium is probably 15 per cent. The color of the light emitted by neon varies from an orange red to a rich crimson, while that of helium is of a yellowish tint.

[1]Claude, *Compt. Rend.*, Vol 151, p. 1122, 1910, and Vol. 152, p. 1377, 1911.

[2]Coblentz, *Physical Review*, Vol 22, No. 1, 1906, and *Carnegie Publication*, No. 35, 1905.

[3]Drew, *Phys. Rev.*, Vol. 17, p. 321, 1903.

Letters to the Editor.

SEMI-AUTOMATIC TELEPHONY.

To the Editor of Electrical World.

SIR: At the Pacific Coast meeting in Los Angeles of the American Institute of Electrical Engineers. Mr. Edward E. Clement presented a paper on "The Semi-Automatic Method of Handling Telephone Traffic." In the course of the discussion, as printed in the October issue of the Institute *Proceedings,* page 2131, Mr. Clement made the following statement:

"Mr. Keller read a very interesting letter from a friend of his in the Siemens & Halske company in Berlin in regard to their work over there. I would not refer to this except that Mr. Keller, in discussing it, stated that he had been surprised to learn that the Germans had been developing along my line. Dr. Raps and Mr. Grabe, of the Siemens & Halske company, have been in touch with me. They were over here several years ago with a party and were given every opportunity to see my work. They are desirous of introducing these improvements in Germany, and I mention this so that no false impressions will arise as to the situation. I do not believe that the Germans or any other foreigners have done any substantial work in developing the automatic or semi-automatic systems in any form in which they appear in this country."

Mr. Clement's remark might possibly be misconstrued in a way which certainly was not intended by Mr. Clement, and in order to avoid misunderstandings I would state the following:

Siemens & Halske have developed their own semi-automatic telephone system entirely independent of Mr. Clement and do not use any of his designs. The fact that Siemens & Halske have extensively worked in the field of semi-automatic telephony since 1907 and have been granted basic and broad patents on this system enables them to build semi-automatic exchanges without being hindered in any way by Mr. Clement's patents. This was done before Dr. Raps and Mr. Grabe came in touch with Mr. Clement, as these gentlemen met for the first time in October, 1908. If there are features common to both systems, it is due to the fact that both systems use certain basic designs which are generally used in nearly all semi-automatic and automatic systems, and to which Siemens & Halske are entitled by special agreements with other companies.

DR. KARL GEORG FRANK,
Representing Siemens & Halske A. G. and Siemens-Schuckertwerke, G. m. b. H., Berlin, Germany.

New York.

COLOR CONTRASTS IN ILLUMINATION.

To the Editor of Electrical World:

SIR:—The law of color contrasts referred to in the article by Dr. Louis Bell in the *Electrical World* of Jan. 27 was first experimentally determined by Chevreul, the eminent superintendent of the Gobelin tapestry works, whose book on the subject, which has been translated into English, still remains classical. Chevreul was not familiar with Young's theory and held to red, yellow and blue as the primary colors, forgetting to distinguish between colored light and colored pigments in so far as the laws governing their mixtures differ.

Professor Rood, sometime artist and professor of physics in Columbia College, brought together in his "Textbook of Color" all the work of Chevreul, Young, Helmholtz, Maxwell and others, and this book still remains the best and most complete work on the subject. In this textbook the law of color contrasts given by Chevreul is brought into agreement with Young's theory, and its application to painting, illumination and the textile arts is pointed out. The book should be of immense value to illuminating engineers.

It is of interest to note that in the two works above mentioned variation of hue and tone by variation in hue of light is exhaustively treated, the account including all of the data published on this subject recently in the *Transactions* of the Illuminating Engineering Society and elsewhere, except in so far as particular modern illuminants are concerned.

An illustration of the law of color contrast may be made as follows: Paint on a sheet of white cardboard three squares, with, say, 6-in. sides, one with English vermilion, one with chrome yellow and one with artificial ultramarine blue. When dry paint into the center of each square a circle 1 in. in diameter, using lampblack. Lay over the painted cardboard a sheet of thin white tracing paper. The black spot on the red square will appear decidedly green, the black spot on the yellow square will appear decidedly blue, and the black spot on the blue square will appear a grayish yellow.

Exceedingly interesting experiments in color contrasts can be carried out in this way and will serve to show how vital the law of color contrast is in decoration and in painting. The law is also of vital interest to illuminating engineers, as under certain conditions it may enter into a problem in most surprising ways. A slight variation in apparent hue due to variation in the color of impinging light may produce great variation in the contrast effects and so profoundly alter the effect of the decoration.

Contrast effects in shadows are often very pronounced. The writer had occasion to note the shadow cast by an ornamental grill on a grayish cartridge paper when a red glazed lantern was the illuminant. The shadows were decidedly blue-green or cyan blue in hue. Such results may be interesting or very disconcerting in certain cases of decoration.

BASSETT JONES, JR.

New York.

CUSTODY OF DEPRECIATION FUNDS.

To the Editor of Electrical World:

SIR:—The editorial in your issue of Jan. 20 on the "Custody of Depreciation Funds" calls attention in an admirable manner, though all too briefly, to a matter upon which, more than perhaps upon any other, the future prosperity of public-utility companies depends. As your editorial seems to suggest, the question is partly, or perhaps largely, one of account keeping. Perhaps the reason why the vital importance of the method of handling a depreciation fund is not more generally recognized is that one finds some difficulty in understanding that what may seem to be a mere matter of bookkeeping is so important.

Decisions bearing on the custody of depreciation funds and the use permitted to be made of such funds are now largely, and may ultimately be entirely, in the hands of commissions. It seems to the writer that some of these decisions are radically wrong, and if the policies laid down in such decisions be adhered to the writer believes that it will result in putting our public utilities into a financial condition similar to that of the steam railways of England.

Perhaps if engineers generally would concede that the exact fixing of depreciation is impossible, and that even an approximate fixing is frequently questionable, we should accomplish a real advance. It may be easy to tell about when a machine will wear out. It may be easy to put a machine into a condition "as good as new" and to determine the cost of so doing. It is nevertheless wholly impossible to assess an annual percentage of depreciation with any certainty that such percentage is even approximately correct. We cannot certainly say at the beginning of a

year that a definite sum will cover the depreciation that will occur during the year, nor can we any better at the end of the year look back and say that during the year just elapsed depreciation has amounted to so much money. Just here is the point at which there seems to be a conflict of views. It is supposed by some that while depreciation cannot perhaps be predicted in advance with absolute accuracy, yet if an allowance too great or too small be made a correction can be introduced at the end of one or two or three years, when it becomes apparent that the predicted depreciation was in error.

In the writer's opinion it does not usually become apparent that a depreciation allowance set some time before was in error until after the lapse of such time that it is too late to make any effective correction. The history of many small plants, or of substantial elements of large plants, is, at first, operation during a considerable series of years without any great change in efficiency, or in reliability of service, or in outwardly apparent value. Then, rather suddenly, the plant, or element of plant, is superseded. The period of time during which it could be noted that the element was approaching its end has frequently been a small fraction of its total period of service. For the major portion of service life many authorities would have appraised the element at nearly cost value. The point I wish to make is that usually neither the depreciation that will occur nor the depreciation that has occurred over a considerable period of time can be determined with accuracy. Frequently the practical abandonment of a plant element is attributed to other causes than either the wearing out or the development of new types of machinery. Many business reasons, such as consolidations, changes in competitive conditions, development of water-powers, extension of transmission lines, etc.—reasons entirely independent of plant machinery—may suddenly end the useful life of a small plant or of a considerable element of a large plant. The impossibility of predicting such happenings or conditions is obvious.

It would, therefore, appear that depreciation funds not only are likely to be either too large or too small, but are likely to continue to be either too large or too small over a sufficient term of years so that an enterprise may finally have either an excessive sum tied up in a depreciation fund or may be well along toward bankruptcy before waking up to the facts. Furthermore, even though it may appear, after say ten or fifteen years, in some given case that an unnecessarily large fund has been piled up, it still may happen that the unexpected events of two or three more years may show that the fund was in fact none too large.

If the theory of the essentially indeterminate nature of depreciation be conceded, then there will be no dispute over the proposition that rules for handling depreciation funds should not be laid down on the theory that depreciation for any given case is exactly determinable. It would even appear probable that such rules point straight to disaster. To make the meaning clearer let us try to go back twenty years and consider any electrical enterprise of that day. Suppose we can really put ourselves in the mental attitude of twenty years ago, forget for the moment what has happened since, and try to apply some of the present-day rules, not as they would be applied to-day, but as a commission of twenty years ago, with no knowledge of what has happened since, would have applied them. Assume that additions to plant could only have been made by sale of common stock at par. Assume that there had been a modest depreciation fund, such as would then have been thought necessary, say kept in a savings bank. Assume that no net earnings could have been put back in the business. Then let us pass in brief review in our minds what has really happened in twenty years and let us imagine what would have happened to our plant under the assumed conditions.

The history of the municipally owned plants during twenty years gives us some hint. Almost without exception history has been something like this: A plant started bravely. For a few years the local papers were full of the low cost of production and great savings to the community. Then for some years more few news items were given out. Then came an unobtrusive item telling of a bond issue for a new plant. Or perhaps it was an item telling of sale to a private concern at a much reduced figure. It has been generally believed that these municipally owned wreckages came because the public management was inefficient. In the writer's opinion this is not the real explanation. The true reason for the many municipal failures lies, in the writer's opinion, in the incorrect estimation of depreciation and in the improper handling of depreciation funds.

In the case of many privately owned utilities depreciation has similarly been incorrectly estimated and depreciation funds improperly handled. One vital and saving difference, however, has usually existed. The privately owned utility puts a portion of its net earnings back into the property. If the bookkeeping is incorrect or the judgment of the managers faulty, perhaps a part of what they suppose to be net earnings are not really net earnings at all but merely constitute a proper depreciation allowance. No matter what the sums are called on the books, if they go back into the property they may save the enterprise from ultimate financial wreck.

What should be done? We do not wish to ruin either private or public enterprise. Yet, if we concede even the possibility of continuing serious mistakes in the depreciation account, we admit that we are in danger either of ruining an investment or of allowing exorbitant profits. Can there not be a method of making everybody safe—even the public? What is the real harm in letting some net earnings go back into a property, provided the public be not required to pay dividends on property so acquired and provided no excessive dividends be allowed on the money really invested by stockholders? It would be a simple matter for a commission to enforce a proper separation of accounts so that property paid for out of net earnings (or out of a depreciation fund) could not be capitalized. Perhaps it would be even better to permit the capitalization of such property and issue shares therefor, but issue them to "the patrons of the company." The dividends on such stock might be used to public advantage in many ways. It would then be pretty evident that the consumers had a real interest in the business.

A municipal plant might be similarly handled. A municipal plant is owned by all the people. Its consumers are only a fraction of the people. Why should all the people serve part of the people at a loss? Of course, no one would say such a thing is proper. Then why should all the people take any risk of serving part of the people at a loss? Should not the municipality, instead of trying to serve its patrons at exact cost, serve them instead at what seems at the time to be a modest profit, but which may very well turn out in the end to be nearer the cost price than was the first cost estimate? Let us have depreciation funds deliberately large enough to include in them some net earnings. Let us see that these funds are put back into the business. No matter if there is no cash fund to replace a particular machine when it is gone. We have really replaced the machine before it was gone. But let the supervising commissions see to it that any stock issued to capitalize plant bought with real net earnings shall be issued to "our patrons."

The writer believes that any company or municipality that will follow the financial plan herein outlined will have no difficulty whatever in financing its extensions, either by stock or bond issues, as it may prefer.

New York. Geo. L. Hoxie.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Temperature Rise of Electrical Machinery.—H. D. SYMONS AND M. WALKER.—A paper read before the (British) Institution of Electrical Engineers dealing with methods of predetermining the temperature rise in electrical machinery. Data are given on the heat conductivity of insulating materials. The methods of carrying away heat by the circulation of air are discussed, and an account is given of experiments made to determine the amount of heat absorbed by air under various conditions as to temperature and velocity in passing over coils and through ventilating ducts. The heat conductivity of punchings in actual machines is also considered. The chief results reached by the authors are as follows: Sufficient air must be provided to carry away the heat generated. If 100 cu. ft. of air per minute is provided for each kilowatt loss it will in general be sufficient. If the conductivity from heating of all parts is sufficiently good and the air is so distributed that none of it receives a temperature rise greater than 32 deg. C., it may be that 60 cu. ft. of air per minute would be sufficient to keep the machine below 45 deg. C. rise. Sufficient cooling surface must be provided to communicate the heat to the air. For ventilating ducts the formula $h_2 = 0.0014\,v$ may be used, where h is the watts per square centimeter of cooling surface per deg. C. of the difference of temperature between surface and air and v is the mean velocity of the air in the duct in meters per second. For the cooling of the surface of rotors and the internal cylindrical face of stators the following formula may be used:

$$t \text{ deg.} = \frac{333 \times \text{watts per sq. cm}}{(1 + 0.1\,v)}$$

To find the temperature rise of the surface of wire-wound coils upon which the air is blowing with a velocity of v m per second, the formula $h_d = 0.0011\,(1 + 0.54\,v^2)$ may be used.—Lond. *Electrician,* Jan. 26.

Heat Tests of Transformers.—J. T. MORRIS, J. W. ELLIOTT AND D. LEWES.—An account of heat tests of transformers made to determine the applicability of the short-time heating test of S. P. Thompson, recently described in the *Digest.* His method is based on the assumption that the heating follows an exponential law. But the results of the authors given in curves show that not one of the curves is of a truly exponential type. The air-temperature curve has a fairly sharp bend in it, while the iron curve is remarkably straight, at least for the first ten hours or so. The authors conclude that Thompson's method is too inaccurate for practical purposes and involves various practical difficulties.—Lond. *Electrician,* Jan. 26.

Static Frequency Duplicator.—G. VALLAURI.—An illustrated Italian Electrical Association paper. If on two identical magnetic circuits there are wound two equal electrical circuits connected in series and supplied with a sinusoidal alternating current, the potential difference at the terminals of each circuit is at any instant one-half the total potential difference. Hence the magnetization curves of the two circuits are identical. If a second electrical circuit is wound in the same sense on each of the magnetic circuits and is supplied with a direct current, the magnetization cycles of the two curves become unsymmetrical, but are still equal and simultaneous. If, however, the two direct-current magnetizing coils are wound in opposite directions, as shown in Fig. 1, the two hysteresis cycles are still equal but no longer simultaneous. Thus, while the magnetization of one of them is at the sharp peak, the other is at the blunt peak. Hence the induced emfs generated in the circuits linked with the magnetized cores pass through zero (at flux maximum) once rapidly and once slowly. In the direct-current circuit the two emfs are subtracted one from the other, giving rise to an emf having double the original frequency. The same principle used here for single-phase frequency duplicator may be employed for the transformation of poly-

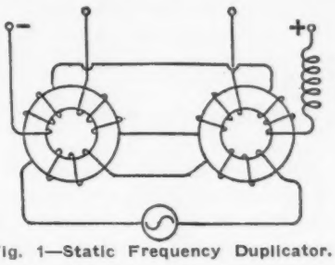


Fig. 1—Static Frequency Duplicator.

phase currents into single-phase current of double frequency, for the transformation of polyphase currents into polyphase currents of double frequency, and, of course, also for doubling the frequency several times over. Experiments made with the arrangement of Fig. 1 show that the double-frequency potential difference may be as much as 70 per cent of the primary potential difference, that it increases in general with increase of the direct current, but that it decreases with the load, the more rapidly the smaller the direct current. The maximum efficiency (about 73 per cent) is realized under the conditions of maximum power. The power-factor in the primary circuit is not very satisfactory, being about 0.3.—Lond. *Electrician,* Jan. 19.

Lamps and Lighting.

Overshooting of Metallic-Filament Lamps.—E. W. MARCHANT.—A communication in which the writer expresses the opinion that the effect of overshooting of the light of metallic-filament lamps is really a physiological one. When the lamp is switched on the pupil of the eye is more expanded than it is when the lamp is lighted. It takes an appreciable time for the iris to adjust itself to the new conditions, and while this adjustment is taking place more light enters the eye, with the result that the light appears to "overshoot." With ordinary circuits having negligible self-induction the current through the lamp, at the working temperature of the filament, cannot be greater just after the lamp is switched on to the circuit than it will be later on, since there is no known time lag of increase of resistance behind increase of temperature.—Lond. *Electrician,* Jan. 5. In a second letter the writer refers to the photographic records of Taylor and Freeman published in the *Electrical World* May 16, 1908, and says that he himself has made experiments with tungsten and tantalum lamps with a view to seeing whether there was any appreciable overshoot of light at the moment of switching on the every-day lamp. The lamps were switched on both when hot and when cold. The method used was to throw an image of the lamp filament on a uniformly rotating photographic film at the instant of switching on. He was unable to detect any variation in the density of the image. The overshoot in Taylor's experiments is believed to be caused by the vacuum being better before the filament heated than it was afterward. It seems possible that the results Taylor obtained may have been due to an exceptionally good vacuum in the lamp. He repeats that the phenomenon of overshoot, as it is observed by everyone, is mainly due to physiological causes. —Lond. *Electrician,* Jan. 12. In a third letter the writer describes some experiments in which photographic records were taken with the intention of repeating the observations of Taylor, but his experiments have shown no overshoot-

ing of light with either 230-volt or 25-volt lamps and therefore give no evidence in support of the phenomenon.—Lond. *Electrician,* Jan. 26.

Metallic-Filament Lamps.—A continuation of the review of progress in metallic-filament lamp manufacture, based essentially on recent German patent specifications. In the present instalment various processes for preparing tungsten powder and making tungsten filaments are described, among them a process of Siemens & Halske for producing a ductile tungsten wire by alloying it with nickel.—*Zeit. f. Belencht.,* Jan. 20.

Arc Lamp.—An illustrated description of the latest French type of the Beck arc lamp, the principal feature of which is its great simplicity of design.—*La Lumière Elec.,* Jan. 20.

Generation, Transmission and Distribution.

French Water-Power Plants.—H. Bresson.—In the latest instalment of his long statistical serial on the hydroelectric stations of France the author gives a list of those in the Garonne district with data on their equipment. He is now also able to give total figures for all the water-power plants in France using either water-power alone or water-power in connection with steam as reserve. His conclusion is that there are at least 1150 such plants in France.—*La Revue Elec.,* Jan. 26.

Speed Regulation of Three-Phase Motors.—G. Meyer.—The concluding part of his article of economic speed regulation of three-phase motors, summing up his final conclusions. He thinks that the three-phase commutator motor will have the largest field, being suitable for all purposes up to 500 hp. In general the series motor is more suitable, while the shunt motor is preferable in special cases only. For ratings above 500 hp two cases must be distinguished, namely, whether speed regulation within limits is required or complete regulation. In the former case a combination using an auxiliary machine, as in the systems of Heyland, Scherbius, etc., may be used, while in the latter case the Ward-Leonard direct-current system is the best.—*La Lumière Elec.,* Jan. 20.

Reversible Oil Engine.—An illustrated description of the directly reversible Diesel oil engine of Hesselman design made by a German company for use on shipboard. It is expected that it will also be used for stationary purposes. Reversing from full load in one direction to full load in the opposite direction can be done smoothly in from 6 to 8 seconds. Thus far fifteen ships have been equipped with this oil engine, with an aggregate rating of 3690 hp.—*Elec. Zeit.,* Jan. 25.

Removing Oil from Steam.—An illustrated description of a new apparatus of Massip for removing oil from exhaust steam which has already proved satisfactory in practice.—*La Revue Elec.,* Jan. 26.

Traction.

Electrification of Trunk Railroads.—W. Reichel.—The first part of a long review of the present status of the electrification of trunk railroads. This development will be gradual and will be first restricted to districts where electrical energy can be produced very cheaply, say at from 0.5 cent to 0.6 cent per kw-hour, or where a considerable increase of the traffic is intended. From the investigations so far made by different organizations it is concluded that under suitable conditions electrical operation of trunk railroads can be from 7 to 12 per cent cheaper than steam traction, without taking into consideration the other advantages of electricity. As to the system to be employed, the author points out the limits of the direct-current system with respect to voltage and corresponding distance of transmission. The principal field for the direct-current third-rail system is on elevated roads and in subways. On the other hand, on such side lines where the traffic is still quite low storage-battery motor cars have proved quite successful in Germany. In the year 1910 lines of an aggregate length of 2840 km (1700 miles) were operated in this way, and this aggregate length had increased by the end of 1911 to 4600 km (2800 miles). The Department of State Railways is quite satisfied with the results obtained with the storage-battery cars on small side lines. For trunk railroads the three-phase system has become of importance only in Italy, although some difficulties have been experienced. The author says that at present the tendency is to consider the use of three-phase series commutator motors because with induction motors operation in parallel has proved difficult at times, but in this way the principal advantage of the three-phase system—namely, that no commutator is required—is lost. The author then takes up the use of single-phase traction. The article is to be continued.—*Elek. Kraftbetr. u. Bahnen,* Jan. 14.

Single-Phase Railways in Germany.—A table giving concise comparative data on the equipment of the two single-phase lines of the Prussian State Railways. These are the lines from Blankenese to Ohlsdorf and from Dessau to Bitterfeld. The data relate to general equipment, trolley-wire construction, equipment of power house, substations and transmission line, and equipment of locomotives and motor cars respectively.—*Elek. Kraftbetr. u. Bahnen,* Jan. 4.

Single-Phase Locomotives for Trunk Railroads.—Extended statistical data on details of construction of the locomotives employed on nineteen single-phase roads in different countries. The data refer to general construction of the locomotives, dimensions, weights, speed and torque and type of motors employed, also to road and transmission-line construction and equipment of the power house.—*Elek. Kraftbetr. u. Bahnen,* Jan. 14.

German Street Railways.—Ph. Scholtes.—An article giving critical statistical data on the number of car rides per inhabitant and the length of trolley lines per 10,000 inhabitants in 1905 and in 1910 in various German cities, also on the relation between increase of number of inhabitants and increase of the receipts by the trolley company in several German cities.—*Elek. Kraftbetr. u. Bahnen,* Jan. 14 and 24.

Installations, Systems and Appliances.

Flat Rate and Double Tariff.—B. Thierbach.—The author compares the advantages for the consumer of a single flat rate and of a double tariff in which special rates are charged for certain hours. He gives a general formula for calculating how many per cent of the total kw-hours must be used at least outside of the special-rate hours in order to make the double tariff more advantageous than a single flat rate or flat rates for motor service and lighting respectively. Numerical examples are added.—*Elek. Zeit.,* Jan. 25.

Luxemburg.—J. P. Manternach.—Besides the large electric generating stations in metallurgical works in Luxemburg which are operated by gas engines with blast-furnace gas, there are only a few small electric central stations supplying towns in the state of Luxemburg. The author describes the first small distributing plant for agricultural purposes in that state. The plant contains a 50-kw, 3000-volt alternator, a 24-kw, 110-volt direct-current generator and a storage battery of 70 cells, besides transformers and motor-generator. The electric current is used for lighting a castle and for motor purposes on a farm and in a distillery which belong to it, besides which several small towns in the neighborhood are supplied with energy for industrial and agricultural purposes.—*Elek. Kraftbetr. u. Bahnen,* Jan. 4.

Wires, Wiring and Conduits.

Wiring Rule.—W. P. Maycock.—The wires of the various circuits emanating from any two-pole distribution board are of three sorts: (a) + wires, in permanent connection with the positive busbar (or what is assumed to be the positive bar in alternating-current work). (b) — wires, in permanent connection with the negative busbar (or what is assumed to be the negative bar in alternating-current

work). (c) Connecting wires; that is, all wires other than above, viz., those running from switches to lamps and other consuming devices. The writer's proposition is that wires with three instead of two easily distinguished outer coverings would be advantageous in wiring work. Leads (+ wires) and returns (— wires) should have a brownish and black color respectively, as at present, while connecting wires should be of some other color, or preferably a braided or other mixture of two colors. The object in view is to facilitate work and any subsequent additions or alterations thereto. The rule can also be extended to wiring diagrams, where red (or thin black) lines would represent positive wires, black (or thick black) lines would represent negative wires and dotted lines would represent connecting wires.—Lond. *Electrician,* Jan. 26.

Wiring System.—An illustrated description of a new wiring system, brought out by an English company, the principal feature of which is the use of bare copper wires in steel casing.—Lond. *Elec. Review,* Jan. 26.

Electrophysics and Magnetism.

Poynting's Theorem.—W. S. FRANKLIN.—A brief mathematical paper in which the author reduces the usual expression of Poynting's theorem and the usual equations of electromagnetic wave motion to familiar expressions involving voltage and current so as to make them clearer to the electrical engineer.—*Jour. Franklin Institute,* January.

Short Electric Waves and Long Heat Waves.—D. OWEN. Summary of the work of Rubens in this field, especially his measurements of dispersion, methods of production of homogeneous infra-red rays, optical properties and electrical conductivity, electric resonance and electric polarization, and the reflecting and absorbing powers of substances for infra-red waves. In the concluding part of the article experiments on short electric waves are discussed.—Lond. *Electrician,* Jan. 5.

Magnetic Rays.—AUGUSTO REGHI.—A paper read before the Academy of Sciences in Bologna. The author formerly made the following observation: If a magnetic field is impressed on an electrodeless ring discharge there is formed a light bundle which follows the lines of magnetic flux and behaves like a bundle of magnetic rays. It would seem that this bundle is formed by the electrons and positive ions which are produced in the ring discharge. The author concludes that quite a similar phenomenon would be produced if instead of the ring discharge an ordinary electric spark discharge was employed, although nothing of the kind has heretofore been observed. The author has now succeeded in observing this phenomenon with a spark discharge in gases of a sufficient degree of dilution.—*Phys. Zeit.,* Jan. 15.

Magnetic Splitting of Spectrum Lines.—P. ZEEMAN.—A lecture given before the French Physical Society on the general case of the magnetic splitting of spectrum lines and its application in astrophysics.—*Phys. Zeit.,* Jan. 15.

Units, Measurements and Instruments.

Flux Meter.—B. H. MORPHY AND U. A. OSCHWALD.—An illustrated description of a simple apparatus for determining the flux distribution in the air-gap of a machine. The movement is shown in Fig. 2, in which, for the sake of clearness,

Fig. 2—Movement (Not to Scale).

its dimensions in the vertical scale are magnified to a much greater degree than in the horizontal. It consists of a slender brass shaft with needle points at each end, carrying a coil of twenty turns of copper wound longitudinally between two notches. The shaft is flattened by filing before being wound, so that flat bases are formed for the coil to lie upon. The ends of this coil are connected through light silver ligaments (*L,* Fig. 2) to terminals (*T,* Fig. 3). The shaft also carries a fine hairspring (*H*) and a square brass block, on the four sides of which small mirrors (*M*) are mounted. The whole movement is mounted between jeweled bearings (*B,* Fig. 3) inside brass tubing. Windows are cut in the larger part of the brass tube so that light may fall from a small osram lamp (*L*) on to the mirrors, after reflection from one of which the beam may be caught upon a scale. The large brass tube is terminated by a socket which

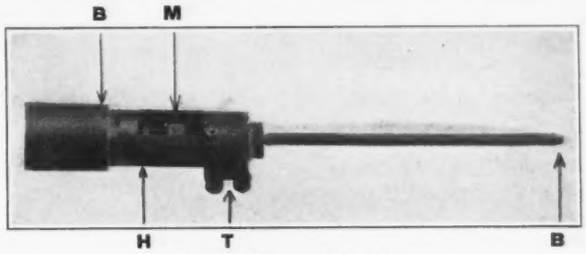


Fig. 3—Movement in Case.

makes a good sliding fit with a projecting cylinder on the arm *A* (Fig. 4). This arm *A* is constructed so that an extension piece (*E*), which carries the lamp and scale, may be securely clamped either at right angles to or in continuation of the line of the arm. The position of the arm and movement relatively to the armature is read on a circular scale and adjusted by means of worm and wheel. When a current is passed through the small coil, which is primarily set so as to lie in a place normal to the armature surface, it tends to run into a plane normal to the flux in which it is situated. This motion is opposed by the hairspring, and the coil takes up a position in which the opposing moments are equal. In practice a current of the order of 0.03 amp is passed first in one direction and then in the reverse through the coil and the deflection of the reflected beam of light on

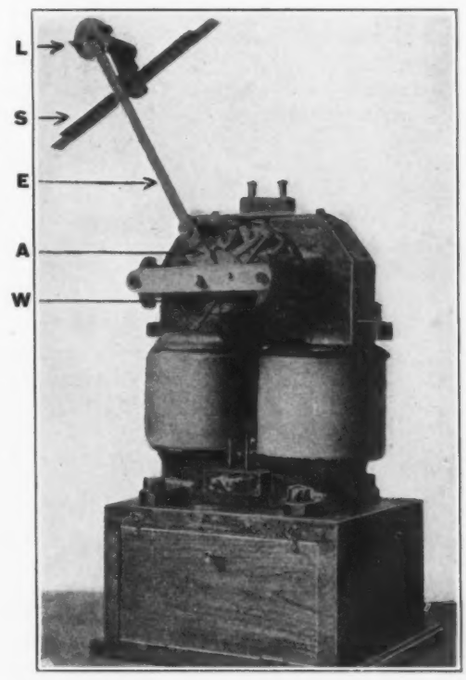


Fig. 4—Apparatus in Position.

the scale is noted in each case. The sum of these two deflections, in units of length, may for most purposes be assumed to be proportional to (1) that component of the flux which is normal to the armature; (2) the current passing through the movement. Curves obtained from typical tests are reproduced and the theory of the instrument is given.—Lond. *Electrician,* Jan. 19.

Double-Tariff Meter.—A note on a recent British patent

(7669, Jan. 18) of the British Thomson-Houston Company (Allgemeine Elektricitäts Gesellschaft of Germany). It relates to a method of driving a type of meter having two mechanisms, one for registering the energy consumption up to a fixed maximum, all in excess of this being registered by the other mechanism. It consists of a differential gearing in which a planet wheel engages two sun wheels. One of these is driven by the meter and the other by a motor at a constant speed corresponding to the fixed maximum, so that the planet wheel will rotate in a direction depending on whether the consumption increases or falls. It is so arranged that the change in direction of rotation causes the shaft driving the registering mechanisms to disengage one and engage the other mechanism.—London *Elec. Eng'ing*, Jan. 25.

Measurement of Spark Potentials Between 20,000 and 300,000 Volts.—P. Villard and H. Abraham.—An account of an investigation carried out with the aid of the French Academy of Science. Between equal spherical electrodes held on symmetrical potentials and with spark lengths smaller than the radius of the spheres, the minimum sparking potential V is practically independent of this radius of the electrodes and is given in volts by the formula $V = 5200 + 26{,}200\,x$, where x is the distance between the electrodes in centimeters. This formula holds good between 20,000 volts and 300,000 volts and shows that in order to increase the spark length by 1 cm in free air in a uniform field it is necessary to raise the potential difference between the electrodes by 26,200 volts. This characteristic constant—26,200 volts per centimeter—is, therefore, the limit of electrostatic strength of air at 15 deg. C. at a pressure of 76 cm of mercury.—*Comptes Rendus,* Dec. 11; *La Lumière Elec.,* Jan. 20.

Telegraphy, Telephony and Signals.

Telephone Exchange.—An illustrated article on the new central-battery telephone exchange in Creechurch Lane, London, which accommodates 9000 subscribers. The special feature of the subscribers' calling circuits is the use of the "ancillary jack" system. Each subscriber's circuit is equipped with three answering jacks and lamps situated at different points on the switchboard. One of the three jacks may be described as the primary answering jack and the others as auxiliary answering jacks. The circumstance

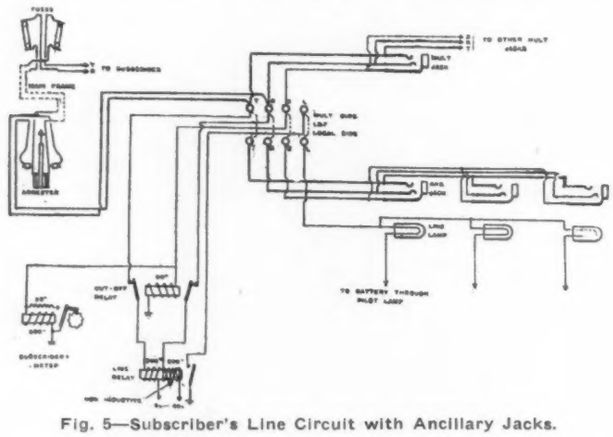


Fig. 5—Subscriber's Line Circuit with Ancillary Jacks.

differentiating the one class from the other is that a disengaged operator in front of whom two lamps (one primary and the other auxiliary) light up simultaneously will answer the call of the primary lamp in preference to the other. The total of 123 subscribers' answering positions may be considered as made up of three groups of forty-one positions per group, each subscriber having a lamp and jack in each of the three groups. The primary answering jacks are arranged on the switchboard at the bottom of the various panels, in the space usually occupied by answering jacks, the ancillary answering jacks being immediately above them. The circuits with primary answering jacks in the first group of positions have ancillary answering jacks in the second and third groups. Similarly those with primary jacks in the third group have ancillary jacks in the third and first group, and those with primary jacks in the third group have ancillaries in the first and second groups. A subscribers' line circuit wired on this system is shown in Fig. 5, the three answering jacks and lamps being connected in parallel. The circuit is equipped with the usual line and cut-off relay. The insertion of the answering plug in any one of the three jacks extinguishes all three lamps. As in other London exchanges, the calls between subscribers in different exchanges constitute the major portion of the traffic, and the rapid and accurate working of junction lines becomes a most important factor. A considerable saving in the time of operating the junction circuits is effected by the use of keyless ringing circuits. Each junction or "B" position has provision for thirty-six keyless incoming junctions and a present equipment of thirty junctions. It is estimated that this method of working junction circuits admits of 25 per cent more junctions being worked from one position than is possible on existing switchboards without keyless circuits.—Lond. *Elec. Rev.,* Jan. 19.

Vector Calculator.—F. Addey.—A vector may be expressed algebraically in two ways, either by the vector length r and its angle δ with a fixed axis or by its two coordinates x and y in the form $x + jy$. The first method is preferable for multiplication and division of vectors, the second method for addition and subtraction. In telephone calculations it is continually necessary to transform a vector from one of these forms to the other by means of the relations $x = r\cos\delta$ and $y = r\sin\delta$. To avoid these calculations the author has devised a simple calculator of squared paper with a pivoted, rotatable, transparent graduated celluloid strip, by means of which the results of the above transformations may be read off directly.—Lond. *Elec. Review,* Jan. 26.

Miscellaneous.

Electrical Resistivity of Special Steels.—O. Boudouard.—An account of an investigation on the change of electrical resistivity of various steels with variation in their composition. In carbon steels the electric resistivity increases with the content of carbon. Nickel steels, manganese steels, chromium steels and tungsten steels were also investigated and the formula of Benedicks giving the electrical resistivity as a function of the alloyed elements was confirmed.—*Comptes Rendus,* Dec. 26; *La Lumière Elec.,* Jan. 20.

Book Reviews.

Elektrochemische Umformer. By Johannes Zacharias, Vienna and Leipsig: A. Hartleben's. 253 pages, 117 illus. Price, 5 marks.

A very practical textbook on primary voltaic cells as actually constructed and used in Germany and Austria. A large amount of information is given concerning the construction, behavior and tests of such cells, from the smallest pocket dry-cells to the largest primary cells in use. A minimum amount of theory is used and no algebra. The book will be of interest to all who are interested in the practical performance of voltaic batteries.

The Care of Automobiles. By Robert E. Sherwood. New York: The Neis Publishing Company. 73 pages. Price, 50 cents.

A handy little pocket-book of a very practical nature on the care of motor cars addressed to car operators and owners both potential and actual. It gives in nineteen short chapters a great deal of information on construction, repairs and proper operation of a motor car and motor. It then follows with a list of "dont's." At the end of all comes a list of "acute automobilia," designed to reduce accidents, such as "Oils well that ends well."

New Apparatus and Appliances

MAGNETO TESTER.

To test magnetos and automobile ignition and timing systems the Butler Manufacturing Company, Carthage, Ind., has developed a device for indicating the exact angular position at which each spark occurs. The chuck-shaft which drives the magneto is geared to a protractor needle revolving over a 360-deg. scale once for each rotation of the driving shaft. This moving needle is insulated from its dial plate and can be connected to the undergrounded side of the magneto circuit. The position of each spark as it occurs is thus indicated clearly on the graduated protractor scale, and correction can be made for improper timing. By the use of the magneto testing device many engine troubles due to faulty ignition can be located and avoided.

LIGHT ELECTRIC DELIVERY WAGON.

Fulfilment of the need for a light-weight economical electric delivery wagon at a price as low as consistent with first-class quality and construction was the purpose of the designers of the new M. & P. delivery car built by the M. & P. Electric Vehicle Company, Detroit, Mich. This car is built in 1000-lb. sizes with either closed or express body. The wheel-base measures 100 in. with 56-in. tread, and the 30-in. artillery-type, twelve-spoke wheels can be furnished with either solid or pneumatic tires. The battery equipment comprises twenty-four Gould lead cells, contained in an underslung battery box. Westinghouse continuous-tongue controller and Westinghouse motors are used, the motor being slung forward of the battery box and just beneath the driver's seat. The live jack-shaft is carried on "New Departure" ball bearings. Meters are provided on the dash for registering both miles and amp-hours. Sixty miles can be made per charge, the average speed being 12 miles per hour.

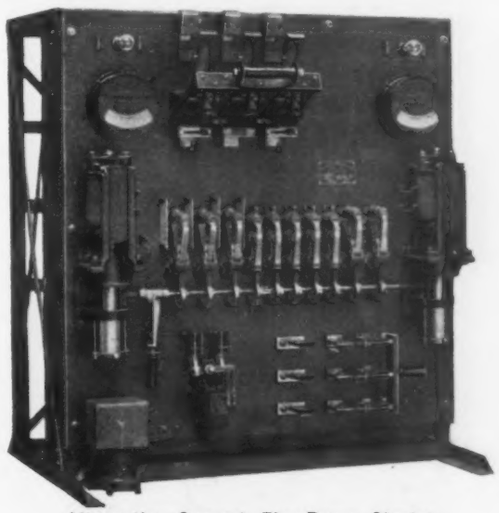
EXHIBITS AT CHICAGO TELEPHONE CONVENTION.

A creditable exhibit of telephonic apparatus and electrical accessories was made during the recent Chicago convention of the National Independent Telephone Association. Something of an innovation in convention procedure was made during the "technical conference" of the association. Chairman Hurtz announced that any exhibitor who had a real novelty on display might have two minutes of the convention's time to describe his new apparatus. Representatives of four companies availed themselves of this invitation. Mr. D. S. Patterson described the new National pole socket made in Pittsburgh, Mr. C. I. Hall the new wooden combined insulator and pin of the Minerallac Electric Company, Mr. Block the liability-insurance plan of the Utilities Indemnity Exchange of St. Louis, and a representative of the Krips-Wright Company, of Philadelphia, the cable carriers and hangers of that company. Tuesday afternoon of convention week was set aside for the inspection of exhibits, and there was no session of the convention at that time. Among the exhibitors were the following:

H. E. Adams Manufacturing Company, Pittsburgh; American Electric Company, Chicago; Automatic Electric Company, Chicago; Baird Electric Company, Chicago; Frank B. Cook, Chicago; Corwin Telephone Manufacturing Company, Chicago; Cracraft-Leich Electric Company, Genoa, Ill.; Dean Electric Company, Elyria, Ohio; Denio General Electric Company, Rochester, N. Y.; Electric Appliance Company, Chicago; Electric Specialty Company, Cresco, Ia.; Electric Storage Battery Company, Philadelphia; Everstick Anchor Company, St. Louis; Fibre Conduit Company, Orangeburg, N. Y.; Holtzer-Cabot Electric Company, Brookline, Mass.; Illinois Electric Company, Chicago; Kellogg Switchboard & Supply Company, Chicago; Krips-Wright Company, Philadelphia; W. N. Matthews & Brother, St. Louis; Miller Anchor Company, Norwalk, Ohio; Minerallac Electric Company, Chicago; Monarch Telephone Manufacturing Company, Fort Dodge, Ia.; National Carbon Company, Cleveland; National Pole Socket Company, Pittsburgh; North Electric Company, Cleveland; Nungesser Carbon & Battery Company, Cleveland; Paragon Sellers Company, Chicago; Pyrene Company, Chicago; Reliable Electric Company, Chicago; Specialty Device Company, Cincinnati; Standard Underground Cable Company, Pittsburgh; Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.; Utilities Indemnity Exchange, St. Louis; Warner Electric Company, Muncie, Ind.; B. F. Wasson, Clinton, Ill.

LARGE ALTERNATING-CURRENT FIRE-PUMP STARTER.

One of the largest alternating-current fire-pump starting equipments ever built has been installed in the new Northwest turbine-generating station of the Commonwealth Edison Company, Chicago. The pump is capable of delivering 2000 gal. of water per minute at a pressure of 150 lb. per sq. in. The 225-hp, 220-volt, three-phase, 60-cycle slip-ring induction motor which operates the pump is automatically



Alternating-Current Fire-Pump Starter.

controlled by the starting panel shown in the accompanying illustration. The starting panel, which was built by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., measures 60 in. by 60 in. Behind the 2-in. slab of oiled slate are mounted the resistor elements.

At the lower right-hand corner is seen the double-throw 600-amp main switch, connecting the panel to either of two sources of supply. At the top is seen the primary overload circuit-breaker, flanked by an indicating ammeter and voltmeter. The signal lamps indicate when energy is available and when the motor is running. The ten cam-operated crank switches at the center of the panel are

closed in succession by the two large alternating-current solenoids, acting through racks and pinions. These solenoids are in turn controlled by the pressure diaphragm at the lower left-hand corner. When the pressure falls to 135 lb. an auxiliary circuit is closed, energizing the clapper switch at the right, which in turn completes the contact to the solenoids. The three left-hand switches of the crank group are in the primary circuit and close quickly through lost-motion links. The carbon blocks with which they are fitted take all arcing and can be easily renewed. The seven switches at the right are secondary contacts, cutting out the secondary starting resistance a step at a time, meanwhile keeping all three phases balanced. The two secondary running switches are shown at the extreme right. If desired, the panel can be operated manually by simply lifting the hand lever shown. The lever is then held in the running position by means of a latch rod extending the panel. This latch rod is arranged with a no-voltage relay, releasing the hand lever automatically upon failure of the voltage in the same way as with automatic starting. The controller panel is moisture-proof and will be inclosed in a splash-proof case. All springs are of phosphor-bronze, and iron parts are copper-plated.

POLE SOCKET.

At the recent Chicago convention of the National Independent Telephone Association there was exhibited a new pole socket that attracted considerable attention. This appliance is intended to give to poles decayed at the ground line a new lease of life. It consists of a cylinder or tube of steel, coated inside and out with asphaltum, and is made in various sizes. The sample shown and illustrated in the accompanying cut is 7 ft. high and 12 in. in outside diameter. The metal shell is 3/16 in. thick. It is intended to be placed 5 ft. deep in the earth, projecting 2 ft. above

Pole Socket.

the ground. At the ground line there is an indentation in the tube contracting the diameter at this point to 10 in., as shown in the illustration.

When a partly decayed pole is to be transferred to a socket it is cut off at the ground, after attachment to a lifting jack. Then it is moved aside from the old location about 1 ft. and shaped with axe and draw-knife to go into the upper portion of the pole socket. In the meantime the tube has been placed in the hole prepared for it and tamped in position. It is then filled with concrete (or partly with earth and partly with concrete) up to a distance from 1 ft. to 2 ft. below the ground line. Grout is poured into the tube on top of the concrete to a level of about a foot above the ground. When this is done the pole, with butt shaped as shown in the cut, is raised by the jack and lowered into the socket. If properly shaped there will be two points of contact between the socket and the pole butt. The lower one is at the ground-level contraction and the upper one, 2 ft. above, is at the rim of the socket. When the pole enters the socket the grout is squeezed up and around it, filling all the space in the socket. After the pole and socket are made plumb the space in the hole around the tube is filled in with earth or concrete, as required.

It is said that the entire work of resetting a large pole can be done in one hour by three men. In soft earth a wooden block should be placed in the bottom of the hole for the tube to rest on. For poles 8 in. or 9 in. in diameter sockets having the same diameter should be used, but sockets from 10 in. to 18 in. in diameter will accommodate poles having a respective diameter 1 in. greater. By the use of wedges sockets can be made to accommodate poles of smaller diameter. The wedge is used to tighten the pole in the socket until the grout becomes hard. This socket is known as the National and was exhibited at the Chicago convention by Mr. David S. Patterson, Fitzsimons Building, Pittsburgh. It is advocated as a saving of expense in the reconstruction of pole lines.

140,000-VOLT TRANSFORMERS.

About two years ago the General Electric Company built for the Stanislaus Power Company seven transformers designed for a voltage of 138,500. This was at that time the highest voltage ever used commercially. At the present time the General Electric Company is building transformers which will mark another increase in voltage to be applied to commercial purposes. The Eastern Michigan Power Company is being supplied with twelve single-phase, 60-cycle, 3000-kva transformers, designed for delta connection on its 140,000-volt transmission system. These transformers occupy a floor space of about 11 ft. by 5 ft., having a total height of approximately 19 ft. from floor to the top of the high-tension terminals. Each transformer will contain about 4000 gal. of oil. In addition to the high primary voltage for which these transformers are intended, the design is of special interest in that the transformers, to meet various low-tension conditions, are arranged for the following secondary voltages:

Three transformers are designed for a secondary voltage of 2470 volts in one circuit. Three transformers are designed for simultaneous service on four secondary circuits of 370 volts with 125 kva capacity each, one secondary circuit of 5560 volts with 1000 kva capacity, and one secondary circuit of 44,000 volts with 1500 kva capacity. Three transformers are designed for one secondary circuit of 370 volts with 125 kva capacity, one secondary circuit of 5560 volts with 2250 kva capacity and one secondary circuit of 22,000 volts with 500 kva capacity; and the three remaining transformers are designed for two secondary circuits of 370 volts, 125 kva capacity each, and one secondary circuit of 22,000 volts, 2750 kva capacity.

Standard oil-filled leads are provided. These leads have an over-all dimension of 7 ft. 4 in. and contain about 30 gal. of oil each. They are provided with cast-iron bases which are fitted to the cover and which extend down into the tank well under the oil. The end is equipped with a brass ball, and the whole lead has been developed with the ultimate

aim of reducing the possibility of corona effects. These transformers are designed to withstand a test of 280,000 volts from the high-tension winding to all other parts. The oil-filled leads are also subjected to this high-tension test.

OIL-PRESSURE GOVERNOR FOR WATERWHEELS.

A full line of oil-pressure governors for waterwheels is announced by the Woodward Governor Company, of Rockford, Ill. As the oldest among present successful governor builders, the Woodward company has for forty-two years set a standard of excellence by its well-known mechanical governor, the type to which its output has hitherto been confined. To meet an increased field in the larger sizes the new oil-pressure governor has now been developed. A number of exclusive features and refinements of design mark this new equipment. Fig. 1 shows the pump and governor complete and Fig. 2 the governor mechanism proper.

With changes of speed the flyballs act on the pilot valve, which in turn controls the main relay valve, admitting oil at 100 lb. to 200 lb. pressure to the vertical gate-operating cylinder. A lower floating lever connects the two valves with the lower stem of the flyball governor and causes the movements of the relay valve to correspond with the movements of the stem. The very slight effort needed to operate this pilot valve insures the sensitive and quick operation of the governor. Aside from its small size the pilot valve is further rendered extremely responsive by being kept in continual oscillation through a small range by the eccentric governor pulley. The ingenious compensating device with which this quick-acting governor is provided is operated from the motion of the gate piston itself through the pivot pin and crank arm shown. Movement of the gate mechanism tends to close the relay valve by changing the length of its tie rod through deflection of the upper floating lever. The linkage is made, however, through a pair of pistons moving in the kerosene of the compensating dashpot. While transmitting quickly all sudden short movements, this dashpot action is limited and does not prevent a continuous movement of the gate mechanism when there

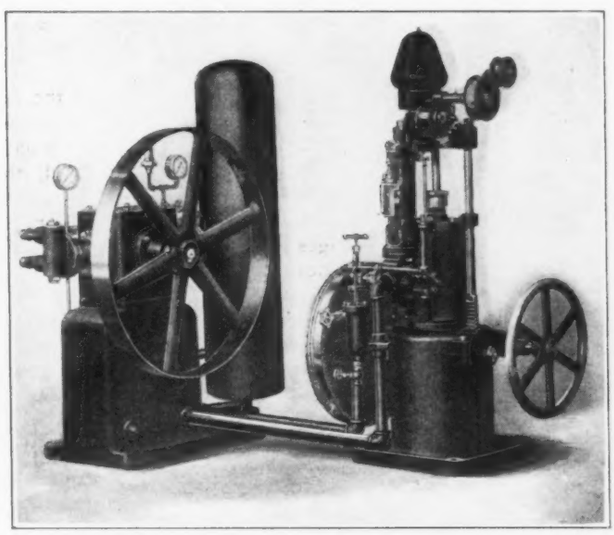


Fig. 1—Woodward Pressure Governor and Compressor Complete.

is a large change of load. A 90-deg. phasing of the lever arms also makes available the most sensitive compensation at small gate openings, where it is most needed. The compensating mechanism can be adjusted during operation. The construction of the dashpot avoids the use of packing, as the chamber is only partly filled with oil. Packing troubles are similarly avoided by the vertical design of the power cylinder and of the pilot and relay valves, insuring the freest movement of the valve stems without opportunity for leakage. The governor is provided with a handle for manually shutting or opening the gate mechanism, in addition to a safety-stop idler pulley, which operates in case of

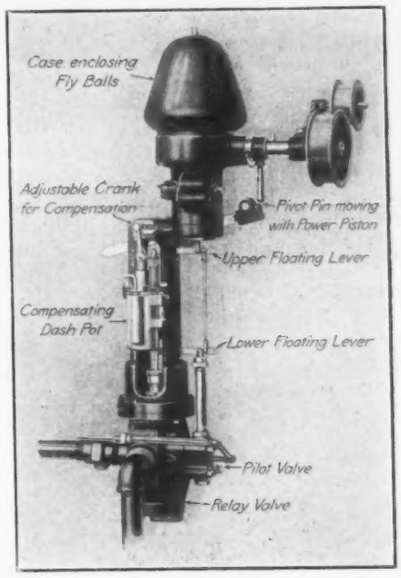


Fig. 2—Controlling Mechanism Detached from Power Cylinder.

belt failure. When desired remote-speed control of the governor can be effected through a small motor attached beneath the flyball casing.

For compactness and flexibility in installation the pump and pressure tank have been built as a unit, separate from the governor proper, thus allowing each to be placed to the best advantage in the plant. Only two pipes are required to connect up the equipment, all other connections being completed at the factory. The pump is of the double-opposed horizontal-cylinder outside-packed type, with inclosed-case splash and chain lubrication. The tank, which is kept half filled with oil overlaid by compressed air at 200 lb. per sq. in., is provided with a special safety valve. For superior reliability of operation this valve is constructed with a comparatively large pressure diaphragm, which on an excess of pressure opens a small aperture through which the excessive pressure escapes.

SELF-STARTERS FOR HIGH-TENSION MOTORS.

A large number of "primary" motors are now in service, using alternating-current energy at pressures of 1100 volts or higher. While the design of self-starters for motors of ordinary pressure has presented no especial problems, the provision of adequate control apparatus for high-tension motors has recently been solved by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., by substituting a solenoid-operated oil switch for the standard air-brake switch used on its starting panels for ordinary slip-ring motors.

Under normal conditions, closing the pilot switch at the control station completes the circuit to the solenoid winding of the oil switch, causing it to close. Current is thus admitted to the primary or stator winding of the motor, secondary currents being induced in the rotor by transformer action. The surge of current in the rotor then has the effect of energizing the first of the three-phase series relays. Lifting this copper disk opens the circuit to the solenoid of the first accelerating switch. An interlock on the primary oil switch is in series with the

relay contacts, so that the accelerating switch cannot close until the primary switch has been closed. As the motor accelerates, the secondary surge dies away until it has fallen to normal load, the relay drops again and the circuit is completed to the solenoid of the first accelerating switch. This closes and cuts out the first step of the starting resistance, permitting a second surge of current and further acceleration of the motor. The second series relay is then lifted and the second accelerating switch is under the control of this relay and of the interlock on the first. The operation is then repeated for the succeeding switches. As the result of the use of the "up," or "closed," interlocks, no switch can close until the preceding switch has been closed, insuring the proper sequence in switch operation. The "down," or "open," interlocked contacts so control the primary switch that it cannot close until all the accelerating switches are down and the resistance cut into the rotor. Should any accelerating switch stick, the panel will automatically remain dead. The solenoid switches are of the same type used on other automatic starting panels built by the Cutler-Hammer company. The main contacts are laminated copper brushes which press against brass contact pieces with a wiping action. An auxiliary contact of carbon to copper takes the arc on opening the circuit.

VARIABLE-SPEED, CONSTANT-CURRENT GENERATOR FOR TRAIN AND AUTOMOBILE LIGHTING.

A noteworthy application of the high positive temperature-resistance coefficient of iron has been made in the variable-speed, constant-current generator illustrated herewith. Between the armature brushes of the generator and the storage battery to which it supplies energy is connected an iron wire resistor, the resistance of which increases enormously when the current exceeds a certain value. An indication of this characteristic of the resistor is given by Fig. 2, which shows that the voltage across the terminals of the resistor as operated in vacuo increases from 1.5 to 7.5 when the current increases from 12 to 16 amp; that is to say, with an increase of 33 per cent in the current the resistance increases by 375 per cent and the consumed voltage by 400 per cent. Thus, even with constant field excitation, automatic increase in the resistance of the resistor would tend to limit the current delivered by the generator to the battery, although with extreme variation in generator speed, as encountered upon the railway car or automobile, the energy loss in the resistor would be excessive. However, the increase in voltage across the iron-wire resistor is used also to produce a proportional decrease in the field excitation, so that the voltage of the generator tends to remain nearly constant independent of the speed at which it is driven, and the energy lost in the resistor is but a small proportion of the total output. In shunt with the iron-wire resistor is a field coil the mmf of which is in a direction to oppose that of the main field coil, which is connected directly across the terminals of the battery.

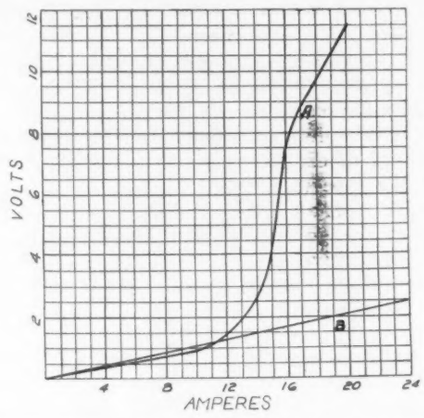


Fig. 2—Curves A and B, Showing Behavior of Ballast Coil and German Silver Respectively with Increasing Current.

The resistance of the "bucking" coil is considerably greater than that of the "ballast" resistor when the latter is cold or only slightly heated. However, when the ballast resistor becomes heated with current its increased resistance forces the bulk of the current delivered by the generator to pass through the bucking coil, thereby greatly increasing the counter excitation produced by the latter. As the strength of the magnetic field is due to the difference between the exciting effect of the main shunt-field winding and the bucking coil, it follows that by suitably proportioning the ballast coil and the bucking coil to the other elements the variation in the current may be as small as desired.

The generator is proportioned to produce a small current at battery voltage at speeds as low as 200 r.p.m. of the automobile engine. At higher speeds the current—but not the voltage—increases rapidly until about 12 amp is reached at about 600 r.p.m. At still higher speeds the current remains practically constant, no matter how fast the engine runs, and does not exceed 14 amp under any conditions. The value of the delivered voltage is that of the battery for which the lamps used are best suited. In this respect the generator has been found superior to an ordinary shunt-wound generator for battery charging, as it delivers to the battery a practically constant current even though the plates be badly sulphated and the resistance greatly increased. As applied to the automobile the generator is capable of supplying all the energy required by the lamps

Fig. 1—End View of Generator.

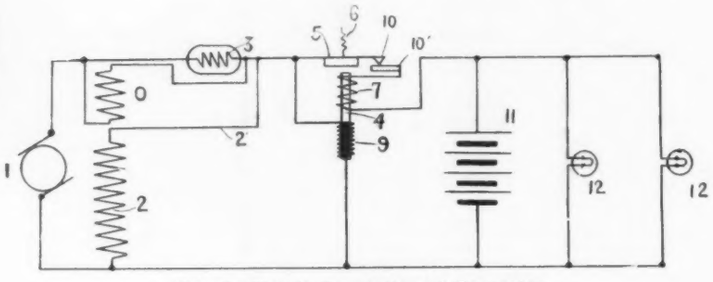


Fig. 3—Circuit Connection of Generator.

and sufficient excess to keep the battery fully charged; thus daylight charging is avoided and there is no need for either a voltmeter or an ammeter on the dashboard.

In the construction of the generator itself the simplest possible arrangement has been employed. The entire field magnet ring, which also constitutes the main frame, is simply a steel shell cut from a standard cold-drawn seamless steel tube. The field coils are former-wound and held in place by the stubby pole pieces which they surround. All of the generator parts are completely inclosed, only the automatic cut-out switch and the iron-wire resistor being external to the steel shell.

The above-described system of electric lighting by means of a variable-speed, constant-current generator was the subject of a United States patent issued to Mr. S. W. Rushmore on Jan. 30, 1912. The apparatus has been placed on the market by the Rushmore Dynamo Works, Plainfield, N. J.

TRUSS INSULATOR PIN.

The Electric Service Supplies Company, Philadelphia, has brought out a new insulator pin, known as the Keystone truss pin, which, it is claimed, overcomes every disadvantage of former types of truss pins and in addition has many other important advantages.

Heretofore it has been necessary to cement the complete pin in the insulator before erecting it. With the Keystone truss pin the thimble only is cemented in the insulator, which assembly is afterward mounted on the truss pin. The illustrations herewith show clearly the curved base of the pin with the lips that project over the sides of the cross-arm. This provides a bearing at the edge of the cross-arm. Therefore any pull at the top of the pin tends to lift the pin at its center, throwing a tensile strain on the bolt. It is claimed that with types of separate top pin which do not have the curved base the strain that comes on the stud bolt is a bending strain, resulting in a deflection back and forth each time that the strain comes on the wire in a different direction. As this bending back and forth continues, it

Fig. 1—Details of Truss Insulator Pin.

weakens the bolt and digs a hole in the cross-arm, which permits water to enter and results in rotting and the final loosening of the bolt in the arm. The curved base, moreover, prevents water from settling in or around the bolt hole and prevents the rotting of the cross-arm at this point. The depending lips of the base find a bearing on each side of the arm, prevent the pin from turning and offer a most substantial side-strain construction.

Referring to the accompanying illustrations, the separate top or thimble *A* is designed for cementing into the insulator. This cementing may be done either by the customer or at the insulator factory, the latter being recommended

Fig. 2—Truss Insulator Pin.

because of the low cost and because insulators when received by the customer are at once ready for installation. This thimble is of malleable iron, cored and tapped to screw on to the upper end of bolt *B* as seen.

Bolt *B*, which is of solid drop-forged steel, of either ⅝-in. or ¾-in. diameter and of the proper length to suit the cross-arm in use, is provided with a collar, which serves to hold it on a flange in base casting *D*, thus keeping it from dropping out when it is installed on the cross-arm. Washer *E* and nut *F*, of course, go on the under side of the cross-arm, thus allowing the bolt to be turned around as desired. In using this pin a hole is bored through the arm, the base *D* is placed thereon and is held rigidly in place by the bolt *B* and nut *F*. The upper threaded end of the bolt *B* now projects above the top of casting *D*, and to this projection the insulator is screwed. If it does not align properly with the wire it is only necessary for a man to loosen the nut *F*, turn the insulator, bolt and all, until the groove is in the proper direction, then tighten the nut again. This allows the insulator to be adjusted exactly in alignment with the wire and at the same time remain absolutely tight on the pin.

The Keystone truss pin features are also provided in a ridge iron and in a pole-top pin. By using this assembly the same insulators with separable thimbles cemented therein will fit either cross-arm, ridge iron or pole-top pins. The great advantage of this fact will be readily appreciated. It is claimed that the following important advantages may be obtained from the Keystone truss pin:

1. It can be used wherever any insulator with thimbles cemented in is used. 2. The groove of the insulator can be aligned perfectly with the wire and at the same time the insulator and pin be kept perfectly tight. 3. Lead does not need to be used at all to obtain flexibility in aligning the insulator with the wire. 4. All cementing is done under ideal conditions rather than in the field; consequently perfect results are always obtained. 5. The pin behaves perfectly under heavy lateral strains. 6. The insulator can never come loose under service conditions. 7. It is very easy to install in the first place, and damaged insulators can easily be replaced with new ones. 8. The pin cannot turn on the cross-arm. 9. Wood under the pin and around the bolt hole cannot rot, thus adding life to the cross-arm. 10. Used in connection with ridge iron or pole-top pin construction, all of the advantages of use as a cross-arm pin apply and but one standard insulator is needed.

Industrial and Commercial News

ALTHOUGH increase in the turnover is not being made very rapidly at present, there is reason to believe that progress is being made, and that a period of real improvement is approaching. Stocks of merchandise on hand are moderate in volume, there is an abundance of funds available at low rates to finance new projects, and the only factor that seems to be needed in order for trade to expand is sufficient confidence in the future. Unfilled orders on the books of the United States Steel Corporation on Jan. 31, announced late last week, were 5,379,721 tons, comparing with 5,084,761 tons on Dec. 31. Among other statistics issued since last report was the fortnightly bulletin of the American Railway Association, which placed the surplus of idle cars in the United States and Canada on Jan. 31 at 32,581, as compared with 90,285 two weeks previous. Transactions on the New York Stock Exchange during the week have been irregular, and net price changes have been few in number. Rates in the money market Feb. 14 were: Call, 2¼@2½ per cent; ninety days, 2¾@3 per cent.

THE COPPER MARKET.

Stocks of copper in the United States on Feb. 1, according to the January report of the Copper Producers' Association, were 66,280,643 lb., which is the smallest amount reported since monthly statements have been issued by the association. This surplus compares with 89,454,695 lb. on hand on Jan. 1, and represents a decrease of 23,174,052 lb. in surplus stocks in January, which is nearly twice as much as had been expected. Production in January was 119,337,753 lb., comparing with 122,986,697 lb. in December. Total deliveries were 142,511,805 lb., comparing with 145,227,190 lb. in the preceding month. Domestic deliveries were 62,343,901 lb., comparing with 65,988,474 in December, and were about in keeping with expectations. The sustaining feature of the copper trade during January was the amount of foreign business effected, exports for the month being reported as 80,167,904 lb., as compared with 79,238,716 lb. in December. Consumers have shown only a mild degree of interest in the report, or in rumors of higher prices, discounting the latter by calling attention to the high rate of imports and the increasing output from the smelters. Aside from a slight increase in buying, after issuance of the report, there has been no change of importance in the market. Domestic consumers are now apparently supplied for present needs. Electrolytic is still quoted nominally at 14 cents per pound. Exports during the week have been heavy and the total for the month, including Feb. 14, aggregate 17,878 tons. The daily call on the Metal Exchange Feb. 14 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	13.95	14.12½	.....
February	14.00	14.10	14.05
March	14.00	14.10	14.05
April	14.00	14.12½	14.07½
May	14.00	14.12½	14.07½
June	14.00	14.12½	14.07½

The London market, Feb. 14, was as follows:

	Noon. £	s	d	Closing. £	s	d
Standard copper, spot	62	8	9	62	7	6
Standard copper, futures	63	2	6	63	1	3

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	14.12½c.			13.75c.		
London, spot	£64	5	0	£60	16	3
London, futures	65	0	0	61	10	0
Best selected	68	5	0	65	5	0

INDUSTRIAL AND COMMERCIAL NOTES.

Washington Water Power Company's Annual Meeting.—At the annual meeting of stockholders of the Washington Water Power Company, of Spokane, Wash., on Feb. 6, all the retiring trustees were re-elected with the exception of R. L. Montgomery, of Philadelphia, who was succeeded by Edwin G. Merrill, president of the Union Trust Company of New York. At a meeting of the trustees the retiring officers were re-elected with the exception of H. E. Perks, the treasurer, who was succeeded by Y. M. White. A. F. S. Steele, who has been acting as secretary since August last, was elected to that office. The results of operation for the year ended Dec. 31, 1911, were announced at the meeting. Net earnings were $1,611,177, and the balance available for dividends was $1,054,008, out of which dividends amounting to $939,008 were paid. The balance sheet of the company as of Dec. 31, 1911, shows total assets of $20,798,071; capital stock, $14,076,900; outstanding bonds, $5,731,000, of which $400,000 is in the treasury. The company has no floating debt. In his remarks to the stockholders D. L. Huntington, president of the company, says that the Little Falls power station, which was placed in operation in 1910, was completed in 1911 to its full capacity, now consisting of four generating units, each of 5000 kw rated capacity. Construction of the new power station at Long Lake, 28 miles from Spokane, has proceeded steadily throughout the year. Upon completion of the Long Lake plant the installed capacity of the company's plants will be as follows: Spokane, 12,000 hp; Post Falls, 15,000 hp; Little Falls, 27,000 hp; Long Lake, 66,000 hp; Spokane steam plant, 19,000 hp, making a total of 139,000 hp.

Exchange of Patents Between Western Electric and North Electric Companies.—At the Independent telephone convention in Chicago on Feb. 7 the North Electric Company, of Cleveland, distributed the following announcement: "The North Electric Company wishes to confirm the announcement which was made on Jan. 27 relating to an exchange of patent licenses consummated on Jan. 23, 1912, between the Western Electric Company and the North Electric Company, which was inspired through motives of economy in patent expense and to promote an early standardization of both methods and apparatus for handling telephone traffic, thereby rendering a marked service to the industry. We wish to state that this exchange of patent licenses is the only connection between the interests involved, and to deny without qualification any rumors to the contrary." As the North company has been reckoned one of the Independent telephone manufacturing companies, this interchange of patent licenses may be taken as another indication of the present spirit of co-operation manifest in the telephone industry in the United States.

Isthmian Canal Proposals.—Circular No. 681 of the Isthmian Canal Commission, Washington, D. C., invites proposals up to 10:30 a. m. on March 8, 1912, on motors, centrifugal pumps with motors, pump motor starters and float switches required for the Panama locks and spillways. The motors called for in these specifications are to be 220-volt, three-phase 25-cycle, totally inclosed, mill-type induction motors. Bids are wanted on eighteen motors for guard valve mechanisms, eighty motors for handrail mechanisms, twenty-two motors for spillway-gate machines, 263 motors for operating centrifugal pumps, 149 float switches, 149 automatic starters and ten compensators. Full details can be obtained from the general purchasing officer of the commission, Washington, D. C.

A New California Project.—Advices from Sacramento, Cal., state that a company known as the United Water & Power Company has been formed in that city, with J. D. Stewart as manager, for power and irrigation purposes. Water rights owned by the company on the South Yuba, Bear and American Rivers are said to be capable of producing over 30,000 hp. The cost of developing the company's project is placed at $3,000,000.

Bell Telephone Improvements in Philadelphia.—An appropriation of about $52,000 has been made by the Bell Telephone Company of Pennsylvania for continuing improvements to its service in Philadelphia, and $125,700 has been set aside for a new central office at Broad and Rockland Streets.

Foreign Trade Opportunities.—Several foreign trade opportunities are cited in the *Daily Consular and Trade Reports* under date of Feb. 13. Schedule No. 8111 states that an electric light and power plant is to be established to supply energy for several towns in a Latin-American country, and that an opportunity exists for manufacturers and exporters of electric-light fixtures. Schedule No. 8113 states that negotiations are being conducted in a Latin-American country with regard to a concession for the establishment of a telephone system in one of the cities. A new and complete telephone system will be the outcome of successful negotiations. Schedule No. 8119 calls attention to the fact that a European concern wishes to communicate with manufacturers of dynamos, electric elevators, apparatus for electric-lighting installations, etc. Schedule No. 8112 contains a request from a firm in a Latin-American country for communications from an American house in a position to obtain electrical supplies of various kinds from American manufacturers. Schedule No. 8124 states that an ice plant is to be established in a Mexican town, and that American manufacturers of ice-making machinery can obtain data on the equipment required by corresponding direct with the person named in this schedule. Further information on all of the above can be obtained by addressing the Bureau of Manufactures, Washington, D. C.

Western Electric's January Business.—Sales of the Western Electric Company in the month of January were about 9 per cent under those in January, 1911, on the basis of goods billed out, and were at a rate of approximately $67,000,000 for the year. The falling off was general throughout the country, a 9 per cent decrease being shown in the central and eastern sections, while a slightly better record was made in the southern and western sections. It is stated that as a result of sale last week of the Western Electric stock held by Kellogg Switchbboard interests to the American Telephone & Telegraph Company, the latter now owns all but 15 per cent of the Western Electric Company's authorized and issued stock. This balance is rather widely scattered, and no special effort is being made at present by the American interests to secure it.

Canadian Hydroelectric Development.—Advices from Montreal state that plans for a 50,000-hp hydroelectric development on the St. Lawrence have now been arranged by the newly formed Cedar Rapids Manufacturing & Power Company. The mechanical details are being worked out by Chief Engineer Henry Holgate and a large staff in the Richelieu Building, Montreal. Tenders will probably be called for the dam and power house without much delay, as it is desired to begin active operations in early spring. The site is opposite St. Timothy in the county of Soulanges, where it is expected to have 1000 men at work next summer. D. Lorne McGibbon, the head of the enterprise, is placing $5,000,000 bonds, through New York bankers, with English investors.

Welfare Work at Fort Wayne Lamp Works.—For the benefit of the 150 men and 800 girls employed in the incandescent lamp works of the General Electric Company at Fort Wayne, Ind., a number of improvements are under way. A restaurant will be established where food carefully selected and cooked will be sold at cost. There will also be a girls' rest room and a dispensary, while rooms for the recently established men's club and the library will be provided. K. J. Corkery is president of the men's club, which holds weekly meetings with debates on practical subjects relating to lamp manufacture.

Meeting of Narragansett Electric Lighting Company.—At their annual meeting stockholders of the Narragansett Electric Lighting Company, of Providence, R. I., adopted an amendment to the by-laws increasing the number of members of the executive committee to eight. The board of directors was re-elected and at its meeting the board re-elected all of the officers of the company. The report submitted to stockholders states that the business for the year as a whole was satisfactory.

Annual Conference of H. L. Doherty & Company Managers.—Representatives of the public utility properties operated under the direction of H. L. Doherty & Company met at the office of the company, 60 Wall Street, New York, on Feb. 15 and 16 for their annual conference. This year's conference was called somewhat earlier than usual on account of Mr. Doherty's desire for early presentation of his plan for welfare work for the employees of the company.

Aluminum Notes and Prices.—Demand for aluminum is moderate and the market is steady. Prices Feb. 13 were 19@20 cents on ingots for remelting, in large lots; 31 cents for rods and wire, and 33 cents for sheets.

Financial.

Dallas Electric Corporation Notes.—A new issue of $1,000,000 five-year 5 per cent gold coupon notes of the Dallas Electric Corporation, of Dallas, Tex., is being offered at 95¾ and interest, yielding 6 per cent. A circular describing the offering states that the corporation owns the securities of local companies which do an electric railway and an electric lighting and power business in Dallas, Tex., serving a population of approximately 95,000. The authorized capitalization of the company consists of (1) $4,000,000 first-mortgage, collateral-trust 5 per cent gold bonds, due 1922, all of which have been issued; $50,000 of the issued bonds are held in the treasury and $346,000 have been purchased for the sinking fund and are held by the trustee; (2) $3,500,000 five-year 5 per cent gold coupon notes, due Feb. 1, 1917, of which an initial issue of $1,000,000 is now being made; the company covenants that, should it place any further lien or encumbrance upon its property, it will secure these notes equally with the other obligations to be secured thereby; (3) $2,000,000 first preferred 6 per cent cumulative stock, $2,000,000 second preferred 5 per cent non-cumulative stock, and $3,000,000 common stock; all of each class has been issued. The company operates 19.7 miles of single track, 19.1 miles of double track and 4 miles of sidings, equivalent to 61.9 of single track. Energy is supplied from a central station located on the Trinity River, having a capacity of 5,800 kw. The plant contains among other equipment two 1500-kw turbo-generators. The proceeds from the sale of the notes now offered will provide funds for an extension to the company's power station, for the installation of 5000 kw additional capacity, improvements to the railway system, and for extensions of the company's transmission lines. Gross earnings of the company for the twelve months ended Dec. 31, 1911, were $1,632,290; operating expenses were $1,017,943, and net earnings were $641,347. Interest charges and taxes were $295,126, and sinking fund charges were $36,077, leaving a balance of $283,143. The principal franchises of the various companies controlled by the Dallas Electric Corporation expire in 1922.

California-Oregon Power Merger.—Twenty-nine electric companies of Southern Oregon and Siskiyou County, Cal., have been consolidated under the corporate name of the California-Oregon Power Company. The Siskiyou Electric Power & Light Company, of Yreka, Cal., the Rogue River Electric Company, of Medford, Ore., and the Klamath Falls Power Company, of Klamath Falls, Ore., are the larger companies included in the merger. The territory covered by the new company extends from Grant's Pass, Ore., on the north, to Dunsmuir, Cal., on the south, and from Klamath Falls, Ore., on the east, to Etna Mills, on the west. Among the towns served by the company's 800 miles of high-tension lines are Yreka, Sisson, Ashland, Medford, Fort Jones and Montague. The company owns waterworks in most of the towns.

Oil City (Pa.) Utilities Sold.—It is announced that Brown Brothers & Company, of Philadelphia, have acquired all the stock of the Citizens' Traction Company and the Citizens' Light & Power Company, of Oil City, Pa., and that control of the properties will pass to the purchaser March 1. The Citizens' Light & Power Company was owned and operated by the Citizens' Traction Company.

Lowell (Mass.) Electric Light Company to Increase Capital.—Application has been made by the Lowell Electric Light Company, of Lowell, Mass., for permission to issue 1534 shares of additional capital stock at $100 a share, the proceeds of which are to be used in paying a floating indebtedness incurred in making improvements.

Northern Ohio Traction & Light Statement.—The pamphlet report of the Northern Ohio Traction & Light Company, Akron, Ohio, for the year ended Dec. 31, 1911, has been issued, and it shows a surplus, after charges, of $670,465, which is equal to 6.78 per cent on $9,000,000 common stock, after allowing for 6 per cent on the $1,000,000 preferred stock outstanding. This compares with 6.3 per cent earned on the same amount of common stock in the preceding year. The general balance sheet as of Dec. 31, 1911, shows as follows:—Assets: Cost of road and equipment, $21,921,938; stocks of other companies, $22,130; A. M. Synder, trustee, $43,424; municipal bonds, $338,472; cash on hand and in transit, $32,671; notes receivable, $2,622; due from individuals, $285,245; material and supplies, $104,990; prepaid and unexpired accounts, $5,643; contingent assets, $1,836; total, $22,758,976. Liabilities: Preferred stock, $1,000,000; common stock, $9,000,000; bonds, $10,737,000; accounts payable, $158,710; interest accrued but not due, $52,520; taxes accrued but not due, $83,248; customers' deposits, $1,295; notes payable, $23,820; sundry accounts, $13,991; uncollectible accounts, $108; injury and damage fund, $30,368; depreciation, $500,000; income account, $1,157,911; total, $22,758,976. The company has applied to the Ohio Public Service Commission for authority to issue $2,000,000 additional stock. The proceeds are to be used for completion of the new generating station at Cuyahoga Falls and for additions to the traction properties.

United Light & Power Notes Offered.—New York banking interests are offering $2,150,000 guaranteed collateral-trust 6 per cent three-year notes of the United Light & Power Company of New Jersey, which operates in San Francisco, Cal., through the United Light & Power Company of California. The notes are dated Dec. 1, 1911, and are due Dec. 1, 1914, with interest payable June 1 and Dec. 3. Their price is 99½ and accrued interest, and they are redeemable as a whole or in part on any interest date at 102 and accrued interest. All of the stock of the United Light & Power Company of New Jersey is owned by the United Properties Company of California, which also controls through stock ownership the Oakland Traction Company, the Oakland Railways, a number of other railway companies and several water companies. The notes are guaranteed as to principal and interest by the United Properties Company and are secured by deposit of $1,500,000 6 per cent cumulative preferred stock of the United Light & Power Company of California, of $3,000,000 of its common stock and of $2,689,000 of its first and general mortgage 6 per cent gold bonds, due 1945, as collateral.

Southern New England Telephone to Raise Dividend Rate.—In his annual report for the year ended Dec. 31, 1911, President Alling of the Southern New England Telephone Company states that the net increase in stations of all kinds in the Connecticut system of the company in 1911 was 10,313, and that as a result of this increase the total number of stations was 93,196. The net earnings of the company for the year were $565,995, which is equal to 6.44 per cent on $8,792,800 capital stock outstanding. Toward the close of the year, according to President Alling, the directors carefully considered the question of raising the dividend rate from 6 per cent to 7 per cent, to commence with the April 1, 1912, dividend. He states that 7 per cent is under the dividend rate prevailing in public-service corporations in Connecticut, that the board of directors of the company considers that the stockholders are entitled to an increase to 7 per cent, and that this proposition will be favorably considered by them in declaring the April 1, 1912, dividend.

Louisville Proposed Public Service Merger.—The question of a merger of public utilities in Louisville, Ky., is still in an indefinite state. The companies involved in the proposed consolidation are, as previously stated in these columns, the Kentucky Electric Company, the Kentucky Heating Company, the Louisville Gas Company, the Louisville Lighting Company and the George G. Fetter Light, Heat & Power Company. Of these, the two first mentioned are reported favorable to the merger and the others undecided. That the Louisville Gas Company or the Louisville Lighting Company, joint corporations, will figure in the consolidation is doubtful. The city of Louisville owns a big block of Louisville Gas stock, this company in turn controlling the Louisville Lighting Company, and Mayor Head has expressed himself as being unalterably opposed to any merger which does not involve municipal ownership of the proposed consolidation.

Philadelphia Company's Earnings Decrease.—In the nine months ended Dec. 31, 1911, gross earnings of the combined properties operated and owned by the Philadelphia Company, of Pittsburgh, decreased $138,275 and net earnings decreased $815,410, according to good authority. This means 9 per cent earned on the stock, as compared with 11 per cent for the fiscal year ended March 31, 1911. The falling off is attributed to heavy expenditures placed upon the company's railway properties, as a result of a large amount of repaving work done by the city. January business of the company was the largest in its history. It is expected in view of continual improvement in trade conditions in Pittsburgh that the January exhibit of earnings will be followed by equally satisfactory results in February and March, and that the stockholders may consequently expect a continuation of the 7 per cent dividend on the common stock.

Consolidated Gas, Electric Light & Power (Baltimore) Stocks Listed on London Exchange.—H. A. Orrick, president of the Baltimore Stock Exchange, announced on the floor of the exchange recently that the preferred and common stocks of the Consolidated Gas, Electric Light & Power Company, of Baltimore, had been listed on the London Stock Exchange. This will give an official quotation in London of the stocks of the company. A large block of the 4½ per cent general-mortgage bonds of the company had been previously placed in London and listed on the exchange. The listing of these securities on the London exchange was granted after a thorough investigation of the company by the standing committee of the London Stock Exchange. In a recent public statement, J. E. Aldred, president of the company, said that as a consequence of the campaign of education carried on in England many English bankers have visited Baltimore for the purpose of studying the city, its conditions and promise of the future.

Ontario Power Company Bonds Offered.—Banking interests in New York and Philadelphia are offering $33,000 first-mortgage 5 per cent bonds of the Ontario Power Company, of Niagara Falls, Ont. These bonds are due Feb. 1, 1943, and are part of an authorized issue of $12,000,000, of which $7,807,000 is outstanding. They are secured by a first mortgage on the generating plant and distributing stations and intake works of the company. Additional bonds may be issued only for new construction at not exceeding $60 per hp capacity installed.

New Brunswick Hydroelectric Company to Be Formed.—The New Brunswick Hydroelectric Company, of St. John, N. B., with $1,500,000 capital, which proposes to transmit energy to St. John from sites it will develop on the Lepreux and neighboring rivers, will apply to the Legislature in March for incorporation.

American Electric Fuse Company Sold.—Frank B. Cook, of Chicago, announces, under date of Feb. 6, that the United States court has confirmed the sale to him of all patents, patent rights, licenses and good-will of the defunct American Electric Fuse Company, of Muskegon, Mich.

Japanese Electrical Works.—The Osaka Electrical Machinery Manufacturing Company has been formed for the manufacture of dynamos and other electrical machinery, with an authorized capital of 1,000,000 yen. The manufacturing plant is now being constructed at Osaka.

Laclede Gas Light Company's Year.—In the calendar year 1911 the Laclede Gas Light Company, which operates both gas and electric plants in St. Louis, Mo., earned 7.97 per cent on its $10,700,000 common stock after payment of $125,000 in dividends on its preferred stock.

MARKET PRICES.

	Feb. 7.	Feb. 14.		Feb. 7.	Feb. 14.
Allis-Chalmers	⅞*	1	General Electric.....	157	157
Allis-Chalmers, pf...	7*	7*	Mackay Companies..	78	81
Amalgamated Cop...	61	64⅛	Mackay Cos., pf....	70	69½*
Boston Edison 299		299	Philadelphia Elec....	17⅞	18⅛
C'monwealth Edison.	139¾	139	Western Union.....	83¼	83⅞
Elec. Storage Bty...	54	54½	Westinghouse	71⅜	71½*
Elec. Stor. Bty., pf.	30*	30*	Westinghouse, pfd...	120*	120*

*Last price quoted.

Personal.

Mr. Hubert E. Collins, secretary of the Institute of Operating Engineers, New York, has started upon an extended trip to Brazil in a consulting capacity for J. G. White & Company, New York.

Mr. Emerson L. Franklin has resigned as secretary of the Easton (Pa.) Gas & Electric Company to become general superintendent of the Eastern Pennsylvania Power Company, with headquarters at Easton.

Mr. Samuel Insull will deliver an address on Feb. 20 before the Schenectady Section of the National Electric Light Association. Mr. John F. Gilchrist, president of the association, will be present at the meeting.

Mr. Ward Harrison, industrial lighting engineer of the engineering department of the National Electric Lamp Association, addressed the Nela Engineering Society, of Cleveland, Thursday evening, Feb. 8, on the subject of "Industrial Lighting."

Mr. Kingsley Gould Martin, formerly treasurer of the New York Electrical Society, has been elected treasurer of the technical advertising firm of Ray D. Lillibridge, Incorporated. Mr. Martin will also serve as engineer and writer for the firm.

Mr. J. H. Bigland, of the National Telephone Company's London contract staff, has been appointed contract manager to the Constantinople Telephone Company (Société Anonyme des Téléphones de Constantinople) and will shortly proceed to Constantinople to take up his duties.

Mr. Carl Hering, who has served as president of the American Institute of Electrical Engineers, of the American Electrochemical Society and of the Engineers' Club of Philadelphia, will be given the degree of Doctor of Science by his Alma Mater, the University of Pennsylvania, on Feb. 22.

Mr. J. R. Cravath spoke on "Illumination and Vision" on Feb. 8 at a symposium on the conservation of vision and prevention of blindness, the meeting being held under the auspices of the *Chicago Tribune*, the Chicago Woman's Club and the South Side Branch of the Chicago Medical Society

Mr. A. H. Sikes, formerly sales manager of the Rockford (Ill.) Electric Company and later in charge of the downtown sales office of The Milwaukee Electric Railway & Light Company, has become associated with the Central Hudson Gas & Electric Company, with headquarters at Poughkeepsie, N. Y.

Mr. Edward B. Greene, formerly superintendent of operation of the Penn Central Light & Power Company, Altoona, Pa., has been made general manager to succeed Mr. E. T. Penrose, resigned. Mr. Greene's successor is Mr. H. B. Soper, who formerly had charge of the company's plant at Warrior's Ridge.

Mr. William Gibbons Housekeeper has resigned his position as engineer with the Westinghouse Lamp Company, Bloomfield, N. J. Mr. Housekeeper did considerable development work on wire-type tungsten lamps and at the time of his resignation was in charge of the engineering work on mercury-arc rectifiers, which are at present being manufactured at Bloomfield.

Mr. E. L. West has resigned as vice-president and general manager of the Central Power Company, in order to accept the general managership of the Connecticut River Power Company, with headquarters at Fitchburg, Mass. Mr. L. P. Hammond, sales manager of the company, succeeded Mr. West, with Mr. E. N. Gilbert, chief engineer, as assistant general manager.

Mr. O. M. Rau, who resigned Feb. 15 as chief electrician of The Milwaukee Electric Railway & Light Company, has been appointed general manager of the Commonwealth Power Company, of Milwaukee, which furnishes electrical energy for lighting and motor service in the downtown district of the city. The offices of the company are in the Majestic Building, Milwaukee.

Mr. R. J. Chapman, who for the past four years has been general manager of the Fowler Utility Company, Fowler, Ind., has resigned to become associated with J. W. Swaren, technical advertiser consultant, in the Shawmut Building, San Francisco, Cal. Mr. Chapman received his training at Purdue and Stanford Universities and afterward had a wide engineering experience before becoming associated with the Fowler Utility Company.

Mr. George S. Smith, until recently president of the Boston Chamber of Commerce, has been elected president of the New England Power Company, which is developing the water-powers of the Deerfield River in the Shelburne Falls district of Massachusetts, in co-operation with the Chase-Harriman interests of Boston. Mr. Smith has been identified with various mercantile and banking interests in Boston for some years, and accepted the presidency of the New England Power Company after an unusually successful term at the head of the Chamber of Commerce.

Mr. E. E. Eysenbach, whose resignation as vice-president and general manager of the Consolidated Gas Company, which controls the electric-lighting business in Long Branch, N. J., was noted in our issue dated Feb. 3, has been appointed general manager of the San Antonio (Tex.) Traction Company to succeed Mr. W. B. Tuttle, who continues as vice-president of the company. Mr. Tuttle is vice-president and general manager of the San Antonio Gas & Electric Company, which is controlled by the same interests that control the traction company.

Mr. Clement C. Smith resigned as president of the Eastern Wisconsin Railway & Light Company at the annual meeting of the directors at Green Bay, Wis., on Feb. 6, 1912, to give his entire time to the duties of his office as president of the Wisconsin Securities Company, a holding company for the Green Bay Traction Company, the Green Bay Gas & Electric Company and the Northern Hydroelectric Power Company. Mr. Smith continues as a director of the Eastern Wisconsin Railway & Light Company. His successor as president of that company is Mr. Henry F. Whitcomb. Mr. Smith is a former president of the Wisconsin Electrical Association.

Mr. Henry F. Whitcomb was elected president of the Eastern Wisconsin Railway & Light Company, Fond du Lac, on Feb. 6, 1912, to succeed Mr. Clement C. Smith. Mr. Whitcomb was born in 1848 and entered steam railroad service as agent for the Sheboygan-Fond du Lac Railroad at Sheboygan Falls in May, 1865. He served as clerk to the president and as agent at Sheboygan successively from May, 1869, to January, 1871. In February, 1873, he was appointed general freight and passenger agent for the Milwaukee, Lake Shore & Western Railway, in which position he remained until Oct. 1, 1885, when he was made general manager of that road. On Sept. 27, 1893, he was appointed receiver and general manager of the Wisconsin Central Railway and was made president when the company was reorganized on July 18, 1899. Mr. Whitcomb continued as president of the Wisconsin Central until 1907, and since that time has served as president of the Wisconsin & Northern Railroad, which position he now holds.

Obituary.

Mr. Arthur Walter Ballard, president of the Pacific Gas & Electric Company, Phoenix, Arizona, died in the office of the company on Feb. 8 as a result of a shot from his own revolver. Mr. Ballard was an associate of the American Institute of Electrical Engineers. His brother, Mr. R. H. Ballard, is secretary and manager of the Southern California Edison Company, Los Angeles.

Mr. Thomas W. Hanley, head bookkeeper in the Chicago office of H. M. Byllesby & Company, died on Feb. 8. Mr. Hanley was born in Chicago, Nov. 7, 1877, and eight years ago married Miss Anna Mellen, of Peshtigo, Wis., who, with two sons, survives him. Mr. Hanley was a member of the Knights of Columbus and resided in Morgan Park. A large delegation of officers and employees of H. M. Byllesby & Company attended the funeral on Feb. 12.

Construction.

MONTGOMERY, ALA.—Bids have been submitted to the Board of City Commissioners for furnishing electricity for lighting the streets and public buildings by the Montgomery Lt. & Wtr. Pwr Co. and the Citizens' Lt., Ht. & Pwr Co. The Montgomery company offered to furnish the arc lamps at $35 per lamp per year on a five-year contract and the Citizens' company at $27.39 each per year. The street-lighting service is now furnished by the Montgomery company at $51 per lamp per year.

CLARKSVILLE, ARK.—Bids will be received by the city of Clarksville until March 1 for construction of a 200-hp steam-driven electric-light plant. Estimates will also be wanted on long-radius standard flanged steam-fitting oil and steam separators and traps, feed water-heaters, open-type, steel smokestack and breeching and pipe covering. The cost of the plant is estimated from $20,000 to $25,000. W. N. Gladstone, Fayetteville, Ark., is consulting engineer. T. E. May is chairman of Board of Improvement.

OSCEOLA, ARK.—Bids will be received by the city of Osceola about March 10 for construction of a municipal electric-light plant, to cost from $30,000 to $33,000. The equipment will include direct-connected generating units, boilers, switchboard and distributing system. W. N. Gladstone, Fayetteville, Ark., is consulting engineer, and W. J. Lamb chairman of Board of Improvement.

PINE BLUFF, ARK.—The Citizens' Lt. & Tran. Co. expects to purchase a 500-kw turbo-generator set for its power plant in Pine Bluff.

TEXARKANA, ARK.—The Texarkana Gas & El. Co. contemplates an extension of 2 miles to its transmission lines. W. L. Wood, Jr., is secretary and manager.

EUREKA, CAL.—Contracts will soon be awarded by the Western States Gas & El. Co. for improvements and extensions to its local system, which will involve an expenditure of about $100,000. H. L. Jackman is manager.

LONG BEACH, CAL.—The Southern California Edison Co. has applied to the City Council for permission to extend its lines to Bixby Beach, near Long Beach, where the company proposes to install an electric-light plant.

LONE PINE, CAL.—The Lone Pine Utilities Co., recently organized, contemplates developing a water-power in the Owens River Valley, near the town of Lone Pine. The company is capitalized at $500,000 and the directors are: E. E. Denton, E. Earl Crandall, E. S. Field and J. R. Lockwood, of Los Angeles. The company proposes to utilize water for irrigation, domestic and power purposes.

LOS ANGELES, CAL.—The Pacific El. Ry. Co. contemplates the erection of a large power plant to cost about $750,000 at the model town to be built at Dominguez. Paul Shoup is vice-president.

MARYSVILLE, CAL.—The Oro El. Co. has stopped work on the survey of the proposed route for a transmission line from Oroville to Marysville and has ordered its crew of surveyors to go to Magalia, Butt County, and survey a new route which will take the transmission line across the valley to Willows and then down the west side, passing through districts where a large amount of power is demanded for pumps for irrigation purposes.

OAKLAND, CAL.—The Central Oakland Lt. & Pwr. Co. plans to extend its service to the residence district of the city and will reduce the rate for electricty for lamps from 7 cents to 6 cents per kw-hour.

OXNARD, CAL.—Plans have been completed for a municipal lighting and water system by Olmsted & Gillellen, of Los Angeles. Arrangements are being made for the purchase of the present water-pumping plant. It is proposed to call an election to vote on a bond issue to provide funds for a new water plant and the erection of concrete lamp-posts throughout the city, connected by underground wiring.

PLACERVILLE, CAL.—The Western States Gas & El. Co. contemplates repairs and reconstruction of its flumes in this vicinity, involving an expenditure of about $100,000. Malcolm McCalman, of H. M. Byllesby & Co., Chicago, Ill., has charge of the engineering work.

REDLANDS, CAL.—The installation of an ornamental street-lighting system in the business district is under consideration.

RIVERSIDE, CAL.—Plans are being prepared for the Evans Brothers' Realty Co. for extensive street improvements to be made in River Crest tract, including an ornamental lighting system.

ROSEVILLE, CAL.—The city of Roseville contemplates constructing a municipal electric-light plant to cost approximately $10,000. W. S. Marshalls, Sacramento, Cal., is engineer in charge.

SACRAMENTO, CAL.—The Carly Co., which has acquired property south of Sacramento, contemplates the erection of transmission lines throughout the new tract.

SACRAMENTO, CAL.—All bids received Jan. 29 for installation of an electric freight and passenger elevator on city wharf between O and P Streets were rejected. New bids will be received until Feb. 26. M. J. Desmond is city clerk.

SACRAMENTO, CAL.—Plans are being made by a company, to be known as the United Wtr. & Pwr. Co., for an extensive electric power and irrigation project. The company owns water rights on South Yuba, Bear and American Rivers capable of developing 34,800 hp of electrical energy. The cost of the proposed project is estimated at $3,000,000. James D. Stewart, of Gold Run, is manager.

SAN BERNARDINO, CAL.—The installation of an electrolier lighting system in the business district is under consideration. B. F. Bledsoe is interested.

SAN BERNARDINO, CAL.—The Southern California Edison Co. has awarded a contract for the erection of a high-tension transmission line from Colton to the Los Angeles County line, west of Chino, to West Starkweather, at $12,500. The new line will supply electricity for lamps and motors in a large agriculture district in the Chino Valley.

SAN JACINTO, CAL.—The Southern Sierras Pwr. Co. is planning to erect a transmission line in the San Jacinto Valley in the near future. The company will apply to the City Council for a franchise to supply electricity for lamps and motors here. F. A. Worthley is the representative of the company.

SONOMA, CAL.—Preparations are being made by Messrs. Evans & Brooke, of the electric-light company, for enlarging their plant and rebuilding all of the transmission lines.

SUTTER CREEK, CAL.—The installation of a 100-hp electric compressor at the Keystone Mine is contemplated.

WATSONVILLE, CAL.—Bids will be received by the directors of the Commercial League until Feb. 26 for the installation of an electrolier lighting system. Two propositions will be asked for, one for a system from First Street to Fifth Street, and the other from the bridge to the upper end of Main Street.

WEED, CAL.—The Siskiyou El. Lt. & Pwr. Co. is planning to erect a substation here to supply electricity to the Weed Lumber Co. F. DeMooy is in charge.

COLORADO SPRINGS, COL.—The Manitou Hot Iron Club is interested in a project to install an ornamental lighting system between Colorado Springs and Manitou.

LOVELAND, COL.—Plans are being considered for the installation of a municipal electric-light plant, to cost about $100,000. The proposed plant will be located on Big Thompson River, about 13 miles west of here.

ORDWAY, COL.—The Ordway El. Lt. & Pwr. Co. will establish a 24-hour service about March 1. M. S. Slaughter is manager.

WRAY, COL.—An election will soon be called to vote on the proposition to issue $60,000 in bonds for the erection of a municipal hydro-electric plant and water system. Thomas S. Sheppard, Gas & Electric Building, Denver, is engineer.

WASHINGTON, D. C.—In a communication submitted to Congress by Franklin MacVeagh, Secretary of the Treasury, the erection of a central power plant, at a cost of $1,350,050, and an appropriation of $50,000 for enlarging the power plant of the Bureau of Engraving and Printing are urged. It is proposed that the central power plant shall supply heat, light and power to the Bureau of Engraving and Printing, Department of Agriculture, White House, State, War and Navy Departments, and the proposed new buildings for housing the Department of Justice and Department of Commerce and Labor, and in case of emergency to the Capitol.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 20 for furnishing at the navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 4304—1000 conduit hangers, 3700 insulator hangers. Bids will also be received until Feb. 27 at the same place as follows: Washington, D. C., Schedule 4330—one electric elevator; Schedule 4329—installing one 75-ton crane runway. Newport, R. I., Schedule 4332—building electrical conduits. Charleston, S. C., Schedule 4333—12 watt-hour meters. Lake Denmark, N. J., Schedule 4333—6000 ft. copper wire, 500 ft. enameled iron conduit. Brooklyn, N. Y., Schedule 4338—4000 ft. interior communication cable, 11,000 ft. twin conductor cable, 50 sets telephone head gears and 4000 ft. telephone wire. Applications for proposals should designate the schedule desired by number. T. J. Cowie is paymaster-general, U. S. N.

AMERICUS, GA.—The Americus Gas & El. Co., has applied to the State Railroad Commission for permission to issue $340,000 in bonds and $250,000 in capital stock, the proceeds to be used to take up outstanding obligations and for improvements to its system.

BOISE, IDAHO.—The Crane Falls Pwr. & Irrig. Co. will receive bids for three hydraulic turbines having a rating of 3000 hp each, two exciter turbines of 200 hp each and three alternating-current generators with a rating of 2000 kva each.

PARIS, IDAHO.—The Telluride Pwr. Co., Provo, Utah, has been granted a franchise to install and operate an electric light and transmission system here.

GALENA, ILL.—The Interstate Lt. & Pwr. Co., of Galena, Ill., and Platteville, Wis., has started the construction of a 33,000-volt, three-phase, 60-cycle primary transmission line from Galena, Ill., through Hazel Green and Shullsburg to Darlington, Wis.; also an extension of its 33,000-volt aluminum transmission line from Platteville north through the township of Lima into the mining district of Mifflin Township. F. H. Rickemann is manager.

GENEVA, ILL.—Bids will be received by the Board of Administration, Springfield, Ill., until Feb. 19 for electric-wiring alterations at the State Training School, Geneva, Ill.; plans and specifications may be

obtained upon applicattion to W. Carbys Zimmerman, architect, Steinway Hall, Chicago, Ill.

MOKENA, ILL.—The Public Service Co. has applied to the Village Board for a franchise to supply electricity here. The company asks for a 50-year franchise and offers to furnish 20 street lamp clusters, consisting of three 40-cp lamps and 10 single 40-cp lamps, to burn until 1 a. m., for $900 per year for a period of ten years.

MOUNT GREENWOOD, ILL.—The village of Mount Greenwood has entered into a contract with the Sanitary District of Chicago for furnishing electrical energy for a period of five years from March 15, 1912. The village is to pay $1.25 per hp per month for electricity used for street lighting and for lighting the municipal buildings. The rate for energy for operating the water-works pumping station is $2.20 per hp per month with 24-hour service. Electricity for commercial purposes will be charged at 5 cents per kw-hour. The village agrees to construct and operate a substation at its own expense. The Sanitary District is to erect an overhead 12,000-volt transmission line from the Western Avenue terminal station in Chicago. Series tungsten lamps will be used for street lighting. Post office address is Morgan Park, Ill.

PAXTON, ILL.—The City Council has granted the Consumers' El. Lt., Ht. & Pwr. Co., East St. Louis, a 30-year franchise to supply electricity in Paxton.

CAMDEN, IND.—The Council has granted the Kehoe Lt. & Pwr. Co. a franchise to supply electricity here for commercial lighting. The town has adopted ornamental street illumination.

CRAWFORDSVILLE, IND.—The Indianapolis, Crawfordsville & Western Trac. Co. contemplates building an extension from Crawfordsville to Danville, Ill., a distance of 45 miles, during 1912.

LAPEL, IND.—The Noblesville El. Lt. Co. has submitted a proposition to the Village Board to light this village.

MONTICELLO, IND.—The Tippecanoe River El. Co. is planning to construct and operate electric-generating plants along the Tippecanoe River, near Monticello, work on which, it is said, will begin within the next year. The company is capitalized at $300,000 and the incorporators are: J. W. Lilly, A. C. Ayres, W. D. Jones, W. W. Hammond and Frank C. Ayres.

PETERSBURG, IND.—Proposals will be received at the office of the city clerk, Petersburg, Ind., until March 7, for lighting the streets, city buildings and other public places in the city and for a franchise for furnishing electricity for commercial and domestic use. Specifications and form of contract may be obtained on application to the city clerk. For further information address the city clerk, Petersburg, or R. M. Case, consulting engineer, 48 Monument Place, Indianapolis, Ind.

CLARION, IA.—Messrs. Mozingo & Mack, owners of the local electric-light plant, contemplate the installation of another engine and generator in the plant during the coming summer.

FORT MADISON, IA.—The People's Gas & El. Co., of Burlington, Ia., is negotiating for the purchase of the plant of the Fort Madison El. Lt. Co. and the railway system of the Fort Madison St. Ry. Co. The construction of an interurban railway between here and Burlington is said to be under consideration. C. H. Walsh is secretary and manager of the People's Gas & El. Co.

SIBLEY, IA.—Plans are being considered for the installation of an electric-light plant here. C. M. Madison is interested.

WASHINGTON, IA.—The construction of a dam on the Skunk River in Washington to furnish power for a hydroelectric power plant is under consideration. F. S. Donnell, of Sante Fe, N. M., is interested.

LEBANON, KAN.—The City Council is considering a proposition submitted by outside parties to establish an electric-light plant here. In case the plant is installed transmission lines will be erected to the towns of Esbon and Bellaire to supply electricity.

MACKSVILLE, KAN.—Investigations are being made with a view of establishing a municipal electric-light plant here. Willis Baker is Mayor.

ANNAPOLIS, MD.—The installation of electric-generating machinery at the water-works plant, 4 miles from the city, is being considered.

CENTREVILLE, MD.—Application has been made by the town of Centreville to the State Legislature for permission to issue bonds to erect and maintain an electric-light plant.

HAGERSTOWN, MD.—The Hagerstown-Clearspring Trolley Co. has submitted a proposition to the City Council with a view of securing electricity from the municipal electric lighting plant to operate its proposed railway.

HAGERSTOWN, MD.—Plans are being considered for a large power plant to supply electricity for the Cumberland Valley from Carlisle to Hagerstown and Frederick, to be located on Broad Top, 40 miles west of Chambersburg. A high-tension transmission line will be erected from the plant to Chambersburg. The proposed plant will have an output of 10,000 hp.

HAVRE DE GRACE, MD.—Plans have been prepared by the Pennsylvania R. R. Co. for the erection of a power plant near the west end of the Susquehanna Bridge to operate the automatic signals and light the company's property in Havre de Grace and Perryville.

HOLYOKE, MASS.—The Board of Aldermen has passed to the first reading the $140,000 bond issue of the Gas and Electric Department, the proceeds to be used for extensions and improvements to the electric and gas systems, most of which will be used for improvements to the gas plant.

ROCKLAND, MASS.—The committee appointed to look into the matter of establishing a municipal electric-light plant will make a favorable report at the town meeting in March. William J. Plattner, superintendent of the municipal electric-light and water plant in North Attleboro, has been engaged to prepare plans and estimates for the proposed plant.

CEDAR SPRINGS, MICH.—The proposition to grant the Grand Rapids-Muskegon Pwr. Co. a 30-year franchise to supply electricity for lamps, heat and motors here will be submitted to a vote on Feb. 10.

GREENVILLE, MICH.—The Chippewa Construction Co. has purchased the plant and holdings of the R. J. Tower El. Co. and the Greenville Gas, El. Lt. & Pwr. & Fuel Co., of Greenville, which will be merged with the other plants of the Chippewa company, and will include plants at Mount Pleasant and Stanton.

LAKE LINDEN, MICH.—The Calumet & Hecla Mining Co. is preparing to increase the output of its electric plant by 10,000 hp. It is proposed to install a steam turbine, which will be operated by waste steam. Plans are also being prepared for the construction of a regrinding plant.

MUSKEGON, MICH.—The Board of County Supervisors has entered into a contract with the Grand Rapids-Muskegon Pwr. Co. to supply electricity for the county home for a period of ten years. Under the terms of the contract the county is to pay the company $1,500 toward the cost of erecting a transmission line from Muskegon to the home and installing the system.

SAULT STE. MARIE, MICH.—The State Railroad Commission has granted the Edison Sault Electric Co. permission to issue $150,000 additional capital stock, the proceeds to be used for improvements and extensions to its system.

DULUTH, MINN.—At an election held Feb. 6 the proposition to issue $750,000 in bonds for a municipal electric-light plant was carried.

FLOODWOOD, MINN.—A committee, composed of M. M. Hingeley, A. H. Markkansen, E. B. Robinson and James Markell, has been appointed to secure estimates on the cost of installing a municipal light plant.

ST. PETER, MINN.—The Nicollet County Tel. Co. will install a new central-energy system, at a cost of about $23,000, and erect a new telephone exchange, to cost about $5,000, if granted a 25-year franchise.

CHILLICOTHE, MO.—Bonds to the amount of $10,000 have been voted, the proceeds to be used for extensions to the municipal electric-light plant.

PLAINS, MONT.—The installation of an ornamental street-lighting system in Plains is under consideration.

DANNEBROG, NEB.—The Village Board has granted a franchise to Oscar Carlson & Son to construct and operate an electric-light system here.

HASTINGS, NEB.—The Commercial Club is contemplating the installation of an ornamental street lighting system.

CARSON CITY, NEV.—The Walker River Pwr. Co. will soon begin work on construction of a dam across the East Walker River to impound water for the irrigation of 50,000 acres of land. P. J. Conway, of Sweetwater, and G. P. Costigan, of Sonoma, Nev., are interested.

LAS VEGAS, NEV.—The Muddy Valley Irrig. Co. contemplates the installation of two electric power plants.

RENO, NEV.—The Reno Trac. Co. contemplates building an electric railway from Sparks to the mines in the Wedekind district.

CHESTERFIELD, N. H.—An electric-light system will be installed in Chesterfield. The service will be supplied by the Keene Gas & El. Co., of Keene.

HOLMDEL, N. J.—The Middlesex & Monmouth El. Lt., Ht. & Pwr. Co. has applied to the township committee for a franchise to erect transmission lines in Holmdel.

BATH, N. Y.—The property of the Bath El. Lt. & Gas Co. has been taken over by a new company, which, it is said, will make many improvements and extend the transmission lines to Savona, Avoca, Kanona and other nearby places. C. Clothier Jones, Ardmore, Pa., is president of the new company and S. W. Appleton, Atlantic City, N. J., secretary and treasurer.

ELIZABETHTOWN, N. Y.—C. M. Wood, owner of the local electric-light plant, is contemplating the installation of a new plant early this spring, the equipment to include a 100-hp producer engine and a 60-kw, 1100-volt, 60-cycle generator.

HUDSON, N. Y.—Sealed proposals will be received by Charles H. Strong, president of board of managers of the New York State Training School for Girls, Hudson, N. Y., until March 2, for construction of cottages Nos. 11 and 12, including heating, plumbing and electric work at New York Training School at Hudson, N. Y. Drawings and specifications may be consulted and forms of proposals may be obtained at the office of the New York Training School, Hudson, N. Y., and at the office of Franklin B. Ware, Albany, N. Y., state architect.

ITHACA, N. Y.—It is stated that ornamental street lamps will be given a trial on several prominent streets.

MINETTO, N. Y.—Plans have been completed for an addition to the power house of the Minetto-Meriden Co., 90 x 99 ft., two stories high. H. S. Coffin, Chicago, Ill., is architect.

NEWARK VALLEY, N. Y.—The village officials are negotiating with the Owego Lt. & Pwr. Co. with a view of furnishing this village with electricity for lamps and motors. The project involves the erection of a high-tension transmission line from Owego to Newark Valley.

ROCHESTER, N. Y.—The Rochester Last Works have applied for permission to construct a power house on University Avenue, in the Twenty-first Ward, to cost about $10,000.

ROSCOE, N. Y.—W. E. & O. P. Sprague, of Roscoe, contemplate the installation of a gasoline-engine and storage-battery system to supply electricity for their department store and three smaller buildings adjacent.

SYRACUSE, N. Y.—Plans are being prepared by the Syracuse Ltg. Co. for the construction of four power houses next spring, to be erected at Marcellus, Marcellus Falls, Skaneateles and Skaneateles Junction.

WATERTOWN, N. Y.—Work was begun on the foundation of the new power house of the New York Air Brake Co. on Beebe Island.

LA GRANGE, N. C.—The proposition to issue $30,000 in bonds for the installation of an electric-light plant, water-works and sewer systems and other improvements will be submitted to a vote on March 4. De Leon M. Fields is town clerk.

ST. PAUL'S, N. C.—The electric-light plant owned by Opie Odum, near St. Paul's, was destroyed by fire recently. The plant supplied electricity in St. Paul's. Mr. Odum will rebuild the plant at once.

FARGO, N. D.—It is reported that bonds to the amount of $10,000 have been voted for improvements to the municipal electric-light plant.

VALLEY CITY, N. D.—Plans are being considered for the installation of a cluster-lamp street-lighting system in the business section of the city.

CLEVELAND, OHIO.—Preparations are being made to begin work on the proposed $2,000,000 municipal electric-light plant, which will supply electricity in every part of the city. It is expected that bids will be called for turbines and other heavy machinery by April 1. The plant will probably be located at the Kirtland Street pumping station on the lake shore.

COLUMBUS, OHIO.—The resolution to issue $100,000 in bonds to provide funds for extending the cluster lighting system, including arc lamps in the central portion of the city, passed its second reading at a recent meeting of the Council. Part of the sum will be used for the construction of underground conduits from High Street to the municipal electric-light plant.

ELIDA, OHIO.—The residents of Elida have made arrangements with the Ohio El. Ry. Co. for lighting the streets of the town.

YOUNGSTOWN, OHIO.—Plans are being considered for the installation of an ornamental street-lighting system on Federal Street. The Merchants' Association proposes to pay for the system and the city for maintenance.

FORT SILL, OKLA.—Proposals will be received by D. L. Stone, constructing quartermaster, Fort Sill, Okla., until March 8 for construction, plumbing, heating and electric wiring of ward wing addition and passage to hospital at old Fort Sill, and constructing, plumbing, heating and electric-lighting of dispensary at new Fort Sill.

NORMAN, OKLA.—The Norman El. Lt. & Pwr. Co. has applied to the Council for a 21-year franchise to construct and operate an electric-light plant and street railway. The company expects ultimately to build an interurban railway from Norman to Oklahoma City. J. C. Jonas, Dr. M. T. J. Capshaw and R. C. Hardie are interested.

PAWHUSKA, OKLA.—Sealed proposals will be received by the Mayor and City Council at the office of the city clerk until March 4 for construction, repairs and extensions to the municipal electric-light system. The work will include 25,180 ft. No. 6 weatherproof copper wire, 130 poles complete with cross-arms, pins, insulators and braces, 35 strain insulators, 1000 ft. of ¼-in. guy strain, 33 tungsten street lamps of 200 cp, complete on bracket suspension, one 25-lamp constant-current regulator and transformer. Plans and specifications are on file at the office of L. C. Willis, superintendent of water-works and electric-light plant.

HILLSBORO, ORE.—The City Council is considering the question of calling an election to vote on the proposition to issue $31,000 in bonds for the construction of a municipal electric-light and power plant.

PORTLAND, ORE.—The Southern Pacific Company is planning to double-track and equip for electrical operation both the Yamhill and Fourth Street lines between Portland, St. Joseph and McMinnville and a connection between the Jefferson Street depot and the Fourth Street line in Portland. The improvements will be extended to Corvallis and to Eugene as soon as the work outlined is completed.

CONNEAUT LAKE, PA.—Plans are being considered to organize a company for the purpose of installing an electric-light plant to supply electricity in Conneaut Lake.

JESUP, PA.—Joseph O'Brien, representing the Scranton El. Co., has secured an option on the property of the Jesup El. Lt. Co.

MEDIA, PA.—The lighting committee is contemplating the installation of a 75-kw, 2250-volt, alternating-current generator, direct-connected unit and also one 100-hp boiler in the municipal electric-light plant. The present incandescent lamps will be replaced with Mazda lamps as soon as fixtures have been installed. P. E. Ahern is superintendent.

PROVIDENCE, R. I.—The Connecticut River Pwr. Co., Brattleboro, Vt., has applied to the City Council for a franchise to supply electricity in Providence. It is proposed to erect a long-distance transmission line from its plants in Massachusetts and Vermont to supply energy for commercial and manufacturing purposes.

BISHOPVILLE, S. C.—Negotiations are under way for a 125-hp boiler to replace the two 60-hp boilers in the municipal electric-light plant. It is also proposed to use tungsten lamps for street-lighting. S. P. Sutton is superintendent.

YORKVILLE, S. C.—It is proposed to extend the municipal electric-light system, for which bonds have been voted.

FREEMAN, S. D.—A movement is on foot to establish an electric-light plant in Freeman. Mathias Hafner and son are interested.

ALAMO, TENN.—The Council has granted the Alamo Ltd. & Pwr. Co. a franchise to erect and maintain an electric-light plant here.

LYNNVILLE, TENN.—A proposition has been submitted to the Council to establish an electric-light plant here.

DUBLIN, TEX.—The property of the Dublin Gas & El. Co. has been purchased by Henry and Frank Weiser and associates. The plant, which is located about 1 mile from the business section, will be removed at an early date to a site near the property of the Dublin Mill & Elevator Co.

EDNA, TEX.—The property of the Edna Ice & Lt. Co. has been purchased by E. F. Glaze, of Goliad.

SAN ANTONIO, TEX.—The San Antonio Gas & El. Co. and the San Antonio Trac. Co. contemplate improvements to their system and the purchase of new equipment, which will involve an expenditure of about $300,000, during 1912.

RICHMOND, UTAH.—The High Creek El. Lt. & Pwr. Co. contemplates extending its transmission lines in a number of places and to new fields, the erection of a 350-hp steam plant and also the development of an additional hydroelectric plant. T. E. Daniels is superintendent.

SALT LAKE CITY, UTAH.—The residents and business interests of Garfield have petitioned the Board of County Commissioners to install street lamps on South Fourteenth Street, from the Denver & Rio Grande Railroad tracks to Garfield and in Garfield. The cost of the installation is estimated at from $5,000 to $7,000, and maintenance at about $3,000 per year.

HAMILTON, VA.—The Loudon El. & Ice Co. is being organized for the purpose of installing an electric-light system and ice plant, at a cost of about $25,000. E. A. Cockey, Jr., Windsor Hills, Baltimore, Md., is president.

SEATTLE, WASH.—A committee has been appointed by the City Council to make investigations and select a site and decide on other problems in connection with the construction of the Cedar River power dam, the cost of which is estimated at $1,400,000. Glover F. Perin, E. H. Baldwin and Joseph Jacobs are members of the committee.

MINERAL POINT, WIS.—The Mineral Point Pub. Ser. Co. contemplates extensive improvements and extensions to its transmission lines. The company has been granted exclusive franchises in Mifflin, Rewey, Livingston, Montfort, Highland, Cobb and Edmund.

CALGARY, ALTA., CAN.—Plans are being considered for the installation of an ornamental street-lighting system on the principal streets, the cost of which is estimated at $100,000.

CALGARY, ALTA., CAN.—The ratepayers have voted in favor of the by-law authorizing an expenditure of $360,000 for extensions and improvements to the municipal electric-light plant.

CALGARY, ALTA., CAN.—Bids will be received until March 15 by the city commissioners for one 2500-kw turbo-generator, one 1000-kw synchronous motor generator, one 50-kw motor-driven exciter, and one 25-kw motor-driven exciter. J. M. Miller is city clerk.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by the chairman of Board of Control, Winnipeg, until March 25 for furnishing impregnated paper lead-covered cables to be used in connection with the city's fire and police telegraph systems. Specifications and form of tender may be obtained at the office of the city electrician, City Hall, Winnipeg. M. Peterson, secretary.

BRANTFORD, ONT., CAN.—Plans are being prepared for the installation of 253 cluster lamps to replace the 32 arc lamps now in use in the business district.

ORILLIA, ONT., CAN.—The town of Orillia is planning to erect a transmission line from the power plant of the Simcoe Power Co. at the Big Chute on the Severn River. It is proposed to ask the Legislature for authority to issue debentures for $80,000 to provide funds for same. The town will also ask for permission to purchase electrical energy from other sources and to erect transmission lines to transmit it to the municipality.

WESTON, ONT., CAN.—Preparations are being made for the erection of a power house, to cost $16,000, at the National Sanitarium, Weston. Tenders for power, lighting, heating and laundry equipment will be asked by the National Sanitarium Association, Weston, Ont. Ten-

ders are now being called for the construction of a children's building, to cost $60,000, which include steam heating, electric-lighting equipment, etc. Dennison & Stephenson, 20 King Street, Weston, are architects.

CHIHUAHUA, MEX.—Messrs. Morehouse & Morrill, of Chihuahua, have been granted a concession by the State government to build an electric-light plant here, to cost about $250,000.

New Industrial Companies.

THE ARTHUR McKINNEY COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 by Arthur McKinney, Ira N. Odell and Fred. G. Rice. The company proposes to manufacture and deal in gas and electrical fixtures and appliances.

THE NEHRING INSULATED WIRE & MANUFACTURING COMPANY, of Sycamore, Ill., has been incorporated with a capital stock of $30,000 to manufacture and deal in insulated wire and electrical appliances. The incorporators are: Paul A. Nehring, James W. Cliffe, Thomas M. Cliffe and Louis E. Peck.

THE NEW IDEA ARC LIGHT COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 to manufacture and deal in gas and electric lamps and fixtures. The incorporators are: Leon A. Barezniak, David H. Goldsmith and Samuel Stein.

New Incorporations.

OWENSBORO, KY.—Articles of incorporation have been filed for the Hartford Tel. Co. with a capital stock of $10,000 by William W. Crawford, W. T. Hale and J. Joseph Hettinger, all of Louisville, Ky.

NEW ORLEANS, LA.—The Crescent El. Co. has been incorporated with a capital stock of $3,000 by Frank Gaschek, president and treasurer; James W. Maloney, vice-president, and James Maloney, secretary.

PORTLAND, MAINE.—The Eastern Texas El. Co. has been incorporated with a capital of $4,000,000 for the purpose of constructing electric, street, suburban, interurban and other railways. Clarence E. Eton is president and T. L. Croteau is treasurer, both of Portland, Maine.

PORTLAND, MAINE.—The Michigan Rys. Co. has been incorporated in Maine to acquire and manage railway, electric and gas properties. The company is capitalized at $10,000,000 and the officers are: A. G. McPherson, president; William S. Linnell and William M. Bradley, all of Portland, Maine.

WASHBURN, MAINE.—The Washburn El. Co. has been organized with a capital stock of $10,000 for the purpose of generating and distributing electricity for lamps, heat and motors. Edward M. Hines, of Washburn, is president and Harry D. McManus, of Washburn, treasurer.

ANNAPOLIS, MD.—The Eastern Shore Pwr., Lt. & Ry. Co. has been incorporated with a capital stock of $500,000 by Henry J. Waters, H. C. Webster, J. T. Taylor, Jr., J. W. West and others. The company proposes to build a railroad, electric or steam, beginning at the southern end of Deal's Island, in Somerset County, thence over the island, through Princess Anne to Sinepuxent Bay, with the privilege of extending its system to Salisbury and Pocomoke City, and to run lateral branches not to exceed 15 miles in length.

KALAMAZOO, MICH.—The Michigan United Trac. Co. has been incorporated with a capital stock of $100,000 by Sanford W. Ladd, of Detroit; A. W. McLimont and Robert Morrison.

MINNEAPOLIS, MINN.—Articles of incorporation have been filed for the Municipal Electric Company by Mayor J. C. Haynes under Chapter 141, Laws of 1911, for the purpose of controlling and distributing power generated at the government dam usually called the "high dam" at the Soldiers' Home. The incorporators are: James C. Haynes as Mayor of the "larger city"; Herbert P. Keller, Mayor of the minor city, and John Lind, president of the Board of Regents of the State University.

BEVIER, MO.—The El. Lt. & Pwr. Co. of Bevier has been incorporated with a capital stock of $10,000 by J. W. Nisbeth, D. D. Rowland and W. R. Morgan.

MAYSVILLE, MO.—The DeKalb County Tel. Co. has been incorporated with a capital stock of $25,000 by E. H. Clay, E. A. Hofstater and R. A. Payne.

ST. LOUIS, MO.—The Missouri Transm. Co. has been incorporated with a capital stock of $2,000 by S. W. Fordyce, J. H. Holliday and T. W. White. The company proposes to generate electricity and distribute it in St. Louis and St. Charles Counties. The offices of the company are located in the Third National Bank Building, St. Louis, Mo.

TRENTON, MO.—The Trenton Gas & El. Co. has been incorporated with a capital stock of $50,000 by J. T. Menefee, Clarence Odaniel and Jasper C. Young.

JAFFREY, N. H.—The New Hampshire Water & El. Pwr. Co. has been incorporated with a capital stock of $115,000 by Robert L. Pond, of Jaffrey, N. H.; J. B. Sherer, J. D. C. Rogers, W. T. Austin and B. Whitney, all of Boston, Mass.

JERSEY CITY, N. J.—Articles of incorporation have been filed for the United Lt. & Pwr. Co. of New Jersey with a capital stock of $3,000,000 by Louis H. Gunther, B. Stafford Mantz and John R. Turner, of Jersey City.

PERTH AMBOY, N. J.—The Freehold & Jamesburg Lt. Co. has filed articles of incorporation with a capital stock of $10,000. The incorporators are: William J. Lansley, Charles C. Gates and George W. Beckwith. The company has taken over the property of the old Jamesburg Lt. & Water Co.

FLORAL PARK, N. Y.—The Public Service Corporation of Long Island has been chartered with a capital stock of $20,000 for the purpose of supplying electricity and gas in the following towns and villages on Long Island: New Hyde Park, Floral Park, West Garden City, Jamaica Square, Elmont, Franklin Square, Munson, Fosters, Meadows, Valley Stream, Norwood, Hempstead Gardens, Lakeview, Lynbrook, Hewlett, Cedarhurst, Inwood, Woodmere, East Rockaway, Bellrose, Garden City Park, Lakeville, Manhasset, Thomaston, Great Neck, Port Washington, Flower Hill, Roslyn, Searington, Albertson, East Williston, Little Neck and all intervening territory. The directors are: Henry MacDonald, of Forest Hill; William H. D. Cooper, of Brooklyn, and Joseph MacDonald, of New York, N. Y.

UNION SPRINGS, N. Y.—The Union Springs Lt. & Pwr. Co. has been granted a charter, with a capital stock of $25,000, to build and operate electric transmission lines. The incorporators are: F. L. Mason, L. A. Mason and G. W. Hull, of Syracuse, N. Y.

CLEVELAND, OHIO.—The H. W. Burton Co. has been chartered with a capital stock of $10,000 to generate and distribute electricity for lamps and motors. The incorporators are: H. W. Burton, C. F. Moore, Charles M. Collacott, R. T. Sawyer and John MacGregor, Jr.

CLEVELAND, OHIO.—Articles of incorporation have been filed for the Arcade Service Co. with a capital stock of $10,000 for the purpose of generating and distributing electricity for lamps and motors. The incorporators are: E. J. B. Blandin, W. L. David, John M. Garfield, L. L. McCallum and Thomas H. Jones.

COVINGTON, OHIO.—The Buckeye Lt. & Pwr. Co. has been incorporated with a capital stock of $40,000 to build and operate gas or electric-light plants. The incorporators are: J. H. Marlin, A. W. Landis, John Weaver, John Fenemore and Hugh C. Marlin.

DAYTON, OHIO.—The Algonquin Lt., Ht. & Pwr. Co. has been chartered with a capital stock of $10,000 by J. Elliott Pierce and F. H. Pierce.

DEFIANCE, OHIO.—Articles of incorporation have been filed for the Defiance Utilities Co. with a capital stock of $10,000 by T. T. Ausberry, M. W. Steinberger and H. D. Bakop.

NOBLESVILLE, OHIO.—The Deming Tel. Co. has been incorporated with a capital stock of $10,000 by J. B. Sturdevant, Marion Jessup and B. Jessup.

SIDNEY, OHIO.—The Royal El. Co. has been incorporated with a capital stock of $20,000 by C. R. Bleakney and others.

SANDS SPRINGS, OKLA.—The Sands Springs Pwr., Lt. & Wtr. Co. has been incorporated with a capital stock of $25,000 by Charles Page, C. F. Tingley, George W. Kinney, C. W. Kingsbury and E. A. Page.

STAYTON, ORE.—The Sanitam Lt. & Pwr. Co. has been incorporated by A. L. Shreve, of the Stayton El. Lt. Co.; W. J. Mayo and S. L. Stewart, all of Stayton. The company is capitalized at $25,000, and will operate near Stayton.

ALLENTOWN, PA.—The North Whitehall Lt. & Pwr. Co. has been chartered with a capital stock of $5,000. The directors are: Charles N. Wagner, treasurer; R. P. Stevens and Charles M. Walter, all of Allentown, Pa.

AVONMORE, PA.—The Avonmore El. Co. has been granted a charter with a capital stock of $5,000. The directors are: Thomas S. Henderson, 1808 Brownsville Road, Carrick, Pa., treasurer; H. L. Mitchell, U. W. Tinker, Pittsburgh, Pa.

MERCER PA.—The Mercer Pwr. Co. has been incorporated with a capital stock of $5,000 by William F. Jaxtheimer, William R. Jaxtheimer and N. Wilson, all of Greenville, Pa.

MOUNT WOLF, PA.—A charter has been granted to the Mount Wolf El. Lt. Co. to supply electricity for lamps, heat and power in Mount Wolf The incorporators are: Harrison B. Waltman, Charles A. Greenaway and James J. Gerry.

PITTSBURGH, PA.—The Suterville El. Co. has been granted a charter with a capital stock of $5,000. R. L. Kester, Jr., 125 Gordon Street, Edgewood, Pa., is treasurer.

REAMSTOWN, PA.—The Reamstown El. Lt. & Pwr. Co. has been granted a charter with a capital stock of $5,000. The directors are: George J. Root, of Reamstown, treasurer; Pierce Lesher, of Lancaster; D. S. Martin, of Denver; John G. Root and C. W. Swartz, of Reamstown.

SMITHTON, PA.—The Smithton El. Co. has been chartered with a capital stock of $5,000 and the following directors: H. A. Weiland, 411 Dawson Avenue, Bellevue, Pa., treasurer; H. S. Thatcher, Edgewood Park, Swissvale, Pa., and F. W. Riffner, Sharpsburg, Pa.

GEORGETOWN, S. C.—The Curtis Pwr. Co. has been incorporated with a capital stock of $5,000 by P. H. Powell, J. M. Powell and Capers C. Barr.

LANCASTER, S. C.—The Lancaster Lt. & Pwr. Co. has been incor-

porated with a capital stock of $5,000. The officers are: Leroy Springs, president; T. Y. Williams, vice-president, and W. C. Thompson, secretary and treasurer.

SPRINGFIELD, S. C.—Articles of incorporation have been filed for the Springfield El. Lt. & Pwr. Co. with a capital stock of $20,000. The officers of the company are: J. McB. Bean, president; M. Gleason, vice-president, and J. B. Smith, secretary and treasurer.

SPEARFISH, S. D.—The Belle Fourche & Spearfish El. R. R. Co has been incorporated for the purpose of constructing an electric interurban railway between Spearfish and Belle Fourche. A. A. Moodie, of Belle Fourche; Seth Bulloch, of Deadwood; T. D. Murrin and R. H. Driscoll, of Deadwood, and others are interested in the project.

BAIRD, TEX.—The Baird Lt. & Ice Co. has been granted a charter with a capital stock of $20,000. The incorporators are: P. A. Hooger, W. W. Wedeborn and E. M. Smith.

COTULLA, TEX.—The Cotulla Ice & Pwr. Co. has been incorporated with a capital stock of $7,500 by W. G. E. Rolaff, Richard Wolfsky and Yale Hicks.

DALLAS, TEX.—The Texas El. Co. has been incorporated with a capital stock of $100,000 for the purpose of promoting the construction of city and suburban electric railways. The officers are: J. V. Watkins, president; R. M. Nunley, vice-president; E. H. Conibear, secretary, and A. Ragland, treasurer.

GRAND PRAIRIE, TEX.—The Grand Prairie El. Lt. & Ice Co. has been incorporated with a capital stock of $10,000 by J. E. Payne, E. E. Leusley, E. M. Henley and others.

SAN ANGELO, TEX.—The San Angelo Pwr. & St. Ry. Co. has been chartered with a capital stock of $100,000 by C. C. Kirkpatrick, W. T. Bartholomew and J. D. Sugg.

SINTON, TEX.—The Sinton Ice & Lt. Co. has been incorporated with a capital stock of $10,000 by L. Fouts, R. N. Hodge and Gordon Bullett.

TIMPSON, TEX.—Articles of incorporation have been filed for the Timpson Lt. & Pwr. Co. with a capital stock of $5,000 by J. P. Christopher, Glen Corwine and George M. Bliss.

WICHITA FALLS, TEX.—The Citizen's Lt. & Pwr. Co. has been organized with a capital stock of $21,000 by T. E. Dobson, I. W. Gullahorn and Samuel Levi.

WICHITA FALLS, TEX.—The Falls El. Co. has been granted a charter with a capital stock of $5,000. The incorporators are: Charles K. Kemper, T. L. Farme and H. V. Culp.

WINTERS, TEX.—The Winters Lt. & Milling Co. has been chartered with a capital stock of $10,000 by J. L. Allred, K. F. Roberts and A. K. Doss.

FLOYD, VA.—The Floyd El. Pwr. Corpn. has been incorporated with a capital stock of $25,000. The officers are: S. G. Proffitt, president; C. W. West, vice-president; J. E. Proffitt, secretary, and H. L. Lawson, treasurer.

CASHMERE, WASH.—Articles of incorporation have been filed for the Mission Creek Tel. & El. Co. with a capital stock of $5,000 by A. C. Jones, E. F. Stowell and others.

MARLINTON, W. VA.—The Marlinton Service Co. has been chartered with a capital stock of $30,000 to establish an electric-light plant and water-works system and ice factory.

WESTON, W. VA.—The People's Elec. Lt., Ice & Wtr. Co. has been incorporated with a capital stock of $100,000 to operate ice and cold-storage plants and supply electricity, etc. The incorporators are: M. S. Holt, J. M. Foster, George A. Hatzel, Charles M. Snaith and Ross L. King.

QUEBEC, QUE., CAN.—The Stadacona Lt., Ht. & Pwr. Co. has been chartered with a capital stock of $1,000,000. L. P. Pelletier is president.

Trade Publications.

PREPAYMENT WATTHOUR METERS.—Bulletin No. 4924 describes the General Electric Company's Thomson prepayment watthour meters for direct and alternating current, Types CP-4 and 1P-4.

AUTOMATIC TIME SWITCH.—Bulletin No. 4893, recently issued by the General Electric Company, is devoted to a general description of two automatic time switches manufactured by that company. The bulletin contains diagrams and dimensions.

PRIVATE TELEPHONE SYSTEMS.—In a well-illustrated booklet issued by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., much information is given concerning telephones designed for private-branch service and for automatic or intercommunicating work.

SMALL PLANT DIRECT-CURRENT SWITCHBOARDS.—With this title the General Electric Company has issued Bulletin No. 4919, devoted to a description of panels which are designed for the control of three-wire generators. The panels are arranged for 125 volts and 250 volts and in capacities of from 25 kw to 100 kw.

DIRECT-CURRENT SWITCHBOARDS.—The General Electric Company has recently issued Bulletin No. 4918, which illustrates and describes panels designed by that company for general use in central stations. The list of panels contains both generator and feeder types, and the panels are made for 125, 225 and 600 volts.

DIRECT-CURRENT EXCITER PANELS.—Bulletin No. 4917 of the General Electric Company illustrates and describes direct-current exciter panels for use in connection with alternating-current generator panels when for any reason separate control of exciters is desired. This supersedes the company's previous bulletin on the same subject.

INDUCTION MOTOR.—The Westinghouse Electric & Manufacturing Company has issued Descriptive Leaflet No. 2298, describing its well-known Type CCL induction motor. This leaflet comes in book form and contains complete and detailed views of this type of motor, together with a brief, concise description of its main characteristics.

ALTERNATING-CURRENT SWITCHBOARD PANELS.—Bulletin No. 4901, just issued by the General Electric Company, is devoted to alternating-current switchboard panels with oil switches attached and designed for three-phase, three-wire circuits, 240, 480 and 600 volts, 25/60 cycles. This supersedes the company's previous bulletin on this subject.

SMALL TURBO-GENERATOR SETS.—An attractive bulletin (No. 4887) illustrates and describes the General Electric Company's turbo-generator sets rated at from 5 kw to 300 kw. All of these sets are of the horizontal type and can be arranged to operate either condensing or non-condensing and at any steam pressure above 80 lb. for the smaller sizes and 100 lb. for the larger.

SWITCHBOARD AMMETER.—The Westinghouse Electric & Manufacturing Company has issued Leaflet No. 2330, covering a direct-current (type JL) vertical edgewise switchboard ammeter operating on the D'Arsonval principle with a single air-gap. These meters can be mounted between 5¼-in. centers and are a continuation of the line of small meters recently put on the market by this company.

RAILWAY MOTORS.—The General Electric Company has just issued a bulletin (No. 4920) describing its GE-203A railway motor, which is of the box-frame, commutating-pole type, rated at 50 hp on 600 volts and 40 hp on 500 volts. The motor embodies radically new features of construction which have been developed with a view to effecting greater economy in railway motor operation, and it is considerably lighter per horse-power output than the previous design.

LIGHTING OF TEXTILE MILLS.—Bulletin No. 4906, just published by the General Electric Company, is devoted to the lighting of textile mills, and also describes the new drawn wire GE Edison Mazda lamps, which are particularly suited to this class of illumination. Illustrations of various installations of these lamps are included, and recommendations are made relative to the illumination of various departments of textile mills. The publication is inclosed in a rather striking cover.

BALL BEARINGS.—The New Departure Manufacturing Company, Bristol, Conn., has made a contribution to ball-bearing literature in the form of a 76-page pamphlet, prepared by the company's staff of ball-bearing specialists and engineers, and giving valuable information of a technical character. The pamphlet, which is fully illustrated, is a product of the American Lithograph Company, of New York City, and creditably reflects the skill of that house in modern high-grade catalog work.

LIGHTING OF HOTELS, CAFES AND CLUBS.—An attractive publication just issued by the General Electric Company is devoted to the subject of the lighting of hotels, cafés and clubs. It contains illustrations of many hotels, restaurants, etc., each accompanied by a statement of the number and kind of lamps used in lighting. In addition to this, the publication contains a history of the development of the incandescent lamp, which should be of general interest. The number of the bulletin is 4908.

ARTISTIC LIGHTING FIXTURES.—The Holophane Company, New York, has issued a handsome portfolio containing thirty lighting fixture designs by representative fixture manufacturing firms incorporating illuminating glassware designs recently developed by the Holophane Company. It is noteworthy that not one of the illustrations shows the lamps in other than a directly pendent or upright position. This position has been separately selected by each designer for artistic effects rather than on account of the use of tungsten lamps.

SERIES INCANDESCENT LIGHTING APPARATUS.—Bulletin No. 4900, just issued by the General Electric Company, is devoted to apparatus used in connection with series incandescent street lighting, and supersedes in part the company's previous bulletin on this subject. The bulletin is practically an ordering catalog and contains no description other than that afforded by the illustrations. It lists lamp brackets of various style (giving their dimensions), tungsten economy diffusers, G-E Edison "Mazda" street series lamps, constant-current transformers, switchboard panels and lightning arresters.

OIL CIRCUIT-BREAKERS.—An attractive little folder (No. 4213) of 12 pages, illustrating and describing the advantages and construction of types B, F, H and J oil-circuit breakers, has just been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These breakers cover a wide range of voltage and capacity and are for switchboard and wall mounting, either hand or electrical operation. One feature of interest possessed by all of the breakers described is that of the arrangement, which renders it impossible to hold the breaker in a closed position on a heavy overload or short-circuit.

WOOD PRESERVATION.—The C-A-Wood-Preserver Company, St. Louis, Mo., has issued a well-illustrated pamphlet devoted to its process of wood preservation, which consists in the superficial application of a special grade, imported from Germany, of pure, unadulterated, high-

boiling coal tar, having high fungicidal or germ-killing properties. The trade names "Carbolineum America" and "C-A-Wood-Preserver" have been applied to the preservative material, which has been sold by the present company since 1886. The pamphlet includes a large number of facsimile reproductions of letters of commendation.

ELECTRIC FANS.—The Robbins & Myers Company, Springfield, Ohio, has issued as its 1912 fan catalog, No. 12, a highly attractive 40-page publication in which are illustrated and described direct-current and alternating-current ceiling, desk, oscillating and ventilating fans. The catalog has been prepared with unusual care and executed in excellent style. Both in art work and in completeness of illustration and description it is highly meritorious. The catalog will be sent upon request to electrical dealers who may be interested in the purchase of fans or to engineers or architects who may desire information concerning "Standard" fans.

TUNGSTOLIERS.—The Tungstolier Company, of Conneaut, Ohio, has recently issued an illustrated catalog, No. 110, briefly describing the features embodied in T T C tungstolier separable lighting fixtures. Attention is called to the opportunities afforded by these fixtures, owing to the easily effected interchange of their parts, for evolving various styles or types of fixture to suit the individual taste or the architectural requirements of any specific lighting installation. By means of a cut-leaf method employed in illustrating the various parts, 648 different assembled views of a two-arm fixture are made possible by merely rearranging and turning the four cut sections on which the parts are pictured.

SMALL PLANT ALTERNATING-CURRENT SWITCHBOARDS.—The General Electric Company's Bulletin No. 4904 illustrates and describes three-phase panels for use in small or isolated plants containing but one generator. These panels are not intended for the parallel operation of generators but for installation in a switchboard consisting of two or more panels. Bulletin No. 4905 is devoted to panels designed for small central stations and isolated plants for use with one set of busbars to which the generators and feeders are connected, and suited to the parallel operation of generators. Each of the above bulletins contains connection and dimension diagrams of panels of various sizes.

ELECTRIC FANS.—The General Electric Company's 1912 catalog of electric fans is an attractive one, printed in colors, and contains descriptions and illustrations of the fans manufactured by that company for use in the home, office and public places. The line of fans comprises those suitable for use on desk or table, which are manufactured with fan diameters of 8 in., 12 in. and 16 in. All of these fans are convertible without the use of tools or additional parts, so that any one may be used on a horizontal surface or attached to a wall. They are made in two styles, fixed and oscillating. The publication contains also illustrations and descriptions of the ceiling and column fans manufactured by the company and a line of supply parts for these. The number of the bulletin is 4895.

COOKING BY ELECTRICITY.—The Copeman Electric Stove Company, of Flint, Mich., has issued an attractively printed booklet illustrated in colors and entitled "Cooking by Electricity." The electric stove built by this company, as described in the *Electrical World* of Aug. 26, page 515, is of the fireless-cooker or insulated-oven type, and is provided with a time-switch for starting the heater at a given future time, besides a thermostatic cut-out for shutting off the energy after the required cooking temperature has been reached. If desired, the heating elements can be removed from the ovens and placed on top of the shelf for frying, broiling, etc. The thermostat provided for use with the automatic cut-off is arranged for adjustment to hold the oven at suitable temperatures for warming, boiling, baking and roasting.

THE WESTINGHOUSE 1912 DIARY.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued the 1912 edition of its diary containing much useful information of value to the electrical engineer. In addition to the usual diary features of date, address and memorandum spaces, there are maps of the United States and possessions and of the world, lists of representative hotels in leading cities of the United States, Canada and Mexico, data on railway systems, motors, converters, generators, transformers, lamps, transmission lines, meters, heating apparatus, steam turbines, mechanical driving mechanism, block signals, wiring tables, and convenient formulas for the simpler calculations. The diary is of vest-pocket size, bound in excellent leather, and will be retained in the personal possession of each recipient until the 1913 edition arrives.

FEED-WATER HEATERS.—"What Scale Does to Boilers," a comprehensive compilation of data on the care and treatment of boilers, published by the Harrison Safety Boiler Works, Philadelphia, Pa., now appears in the fourth edition, with amplified statistics and considerable new matter of an engineering nature, especially in regard to recent theories and discoveries in connection with the corrosion of iron by boiler feed-water. A new chart, credited to Dr. Neutlinger, of Cologne, shows that boiler plates covered with scale may rise to temperatures two or three times as great as will clean plates transmitting heat at the same rate. The chapter on corrosion is particularly interesting, especially that section relating to the part played by air in corrosion, in which the latest results of Frofs. Woodbridge and Waker, of the Massachusetts Institute of Technology, Burgess, of the University of Wisconsin, and Heyn and Bauer, of Germany, are quoted. The most valuable result brought out by these investigations is the fact that corrosion may be wholly or almost entirely prevented by heating the water by spraying through an open steam bath, thereby driving off the air and other gases.

ALTERNATING-CURRENT MACHINERY.—The Westinghouse Electric & Manufacturing Company has issued a series of descriptive leaflets dealing with various types of alternating-current machinery. Leaflet No. 2299-A describes slip-ring induction motors designed for service where excessively heavy loads must be started with low starting current. Leaflet No. 2386 describes heavy-duty slip-ring induction motors especially suitable for severe, intermittent, varying-speed revision service, such as the operation of cranes, hoists, elevators, railway turntables and similar installations. Leaflet No. 2387 describes elevator motors designed for driving passenger and freight elevators the speeds of which do not exceed 150 ft. per minute. A detailed description of the construction of these motors, which are of the squirrel-cage type, is given together with photographs of the various parts and also of the elevator switch. Generators for engine drive are clearly illustrated and fully described in Leaflet No. 2390. These generators constitute a standard line of engine-driven, slow-speed, 60-cycle machines. Generators for belt drive are clearly described and illustrated in Leaflet No. 2389. They are designed especially for belt drive and for operation in comparatively small centra stations and industrial plants.

Business Notes.

W. N. MATTHEWS & BROTHER, St. Louis, Mo., have moved their office and factory to their new building at 3722 Forest Park Boulevard.

TOOL STEEL GEAR & PINION COMPANY, Cincinnati, Ohio, has appointed the U. S. Metal & Manufacturing Company, New York, N. Y., and Chicago, Ill., its selling agent in the New England, Middle Atlantic and Southern States.

RESUSCITATION APPARATUS.—Mr. A. E. Sylven, 29 Broadway, New York City, is introducing on the American market the resuscitation apparatus described in our issue of Dec. 23, 1911. It is manufactured by Aktie Bolaget Stille-Werner, Bergsgatan 2, Stockholm, Sweden.

HENRY NEWGARD & COMPANY, electrical contractors and engineers, 947 Washington Boulevard, Chicago, will shortly open a branch office at 276 West Water Street, Milwaukee, Wis. The company has at present considerable contracting work on hand in Milwaukee and vicinity.

GEORGE J. HENRY, JR., Rialto Building, San Francisco, Cal., has published a booklet entitled "Water Power: Its Economical and Efficient Development and Use for Hydroelectric Transmission, Mining and Industrial Plants." Mr. Henry presents in the booklet a brief outline of the character of the apparatus that he is preparing to design and build to suit the peculiarities of each installation.

THE GURNEY ELEVATOR COMPANY.—Following the tendency on the part of architects and builders to locate their offices within the district between Twenty-third and Fifty-ninth Streets along the line of Fifth Avenue, the Gurney Elevator Company has removed its offices to the new Gurney Building, 62 and 64 West Forty-fifth Street. The new building affords the larger office space required for the company's rapidly increasing business.

ECONOMY FUSE AGENCIES.—The Economy Fuse & Manufacturing Company, Pittsburgh, has appointed the Maydwell Company, whose main office is in San Francisco, with branches in Los Angeles and Seattle, to act as its exclusive Pacific Coast agent. The W. G. Arthur Reid Company, of Detroit, Mich., has been appointed exclusive agent for the Economy company in the State of Michigan, with headquarters at 63 State Street, Detroit.

COAL-HANDLING EQUIPMENT FOR AURORA, ELGIN & CHICAGO.—The Aurora, Elgin & Chicago Railroad Company, of Chicago, is making extensive improvements in its power house at Batavia, Ill., and has ordered coal-handling apparatus from the Robbins Conveying Belt Company, a coal crusher from the Link Belt Company, a pneumatic ash-handling system from the Guarantee Construction Company and an electrically operated locomotive crane from the Browning Engineering Company. Six new coal bunkers, each having a capacity of 50 tons, will be built.

TERRY STEAM-TURBINE PUMPS FOR NEW YORK EDISON COMPANY.—The New York Edison Company has placed the order with the Terry Steam Turbine Company for four 1000-g.p.m. boiler-feed pumps to be installed at Waterside station No. 1. The centrifugal pumps are Jeanesville 8-in., three-stage solid bronze pumps and are direct-connected through flexible coupling to Terry single-stage non-condensing turbines. This order makes the twelfth boiler-feed unit of this capacity and make that has been purchased by the New York Edison Company within the last five years.

NEW BUILDINGS OF GOULDS MANUFACTURING COMPANY.—The Goulds Manufacturing Company have just completed a group of four new buildings at Seneca Falls, N. Y., known as Nos. 10, 11, 12 and 13. This group of buildings will be used exclusively by the hand pump departments and provide a very material increase in the manufacturing facilities for this important branch of the company's business. As an example of up-to-date factory construction, they have several features of general interest. The buildings were designed by the engineering department of the Goulds Manufacturing Company, under the direction of Messrs. A. L. McHugh, works engineer, and H. H. Hall, supervising architect.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 6, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,016,268. CIRCUIT-CONTROLLING DEVICE; W. B. Hughes, Newark, N. J., App. filed Jan. 20, 1911. Thermostatic alarm or sprinkler system apparatus.

1,016,277. LOCK-OUT DEVICE FOR PARTY TELEPHONES: N. D. W. Kneisly, Dayton, Ohio. App. filed Feb. 20, 1908. Improvements on Patent No. 860,920. Forty-one claims.

1,016,303. ELECTRIC MEASURING INSTRUMENT; C. H. Thordarson, Chicago, Ill. App. filed June 27, 1910. Meter for storage-battery-charging system, etc.

1,016,329. MULTIPLE-CIRCUIT CONTROLLER; C. K. Jones, New York, N. Y. App. filed June 18, 1910. Key-controlled relay and shift bar.

1,016,353. HOLDER; M. B. Morgan, Detroit, Mich. App. filed Dec. 28, 1910. For holding a magneto to an engine frame.

1,016,399. IGNITION DEVICE; J. F. Cavanagh, Providence, R. I. App. filed April 12, 1911. Combined spark coil and condenser.

1,016,401. AUXILIARIZED FIRE-ALARM BOX; F. W. Cole, Newton, Mass. App. filed March 9, 1909. Improved let-off. (See Patent No. 842,861.)

1,016,430. TROLLEY HARP; F. E. Murphy, Lincoln, Ill. App. filed Feb. 27, 1911. Double wheel with guards.

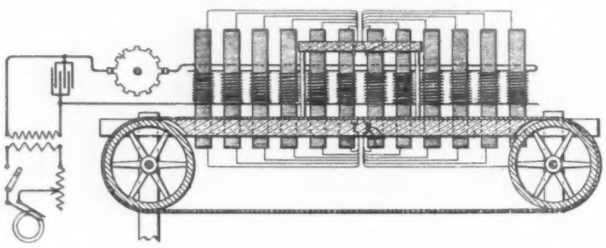
1,016,443. JACKET FOR SAFETY FUSES; C. N. Sachs, Hartford, Conn. App. filed March 11, 1904. Cellular material.

1,016,449. ELECTRICAL APPARATUS FOR DESTROYING INSECTS; F. S. Smith, Philadelphia, Pa. App. filed Jan. 7, 1911.

1,016,450. APPARATUS FOR DESTROYING INSECTS BY MEANS OF ELECTRICITY; F. S. Smith, Philadelphia, Pa. App. filed Jan. 7, 1911.

1,016,451. ELECTRICAL APPARATUS FOR DESTROYING INSECTS; F. S. Smith, Philadelphia, Pa. App. filed March 13, 1911.

1,016,452. ELECTRICAL APPARATUS FOR DESTROYING INSECTS; F. S. Smith, Philadelphia, Pa. App. filed March 13, 1911.



1,016,449—Electrical Apparatus for Destroying Insects.

1,016,453. ELECTRICAL APPARATUS FOR DESTROYING INSECTS; F. S. Smith, Philadelphia, Pa. App. filed March 13, 1911. Five patents on apparatus for treating cereals, tobacco or other insect-infested articles by disruptive discharge.

1,016,460. STARTING MECHANISM FOR ELECTRIC MOTORS; J. J. Walser, Chicago, Ill. App. filed Oct. 11, 1909. Particularly for printing-press control.

1,016,467. TROLLEY RETRIEVER; W. Ashcraft, Grandin, Mo. App. filed Oct. 15, 1908. Pneumatic.

1,016,470. MOTOR CONTROLLER; T. E. Barnum, Milwaukee, Wis. App. filed June 1, 1909. For motor-operated printing presses, etc.; teasing or inching.

1,016,482. COMBINED RELAY, TARGET-SETTING AND RETURN-CALL CIRCUIT-CLOSING DEVICE; E. R. Cunningham, Des Moines Ia. App. filed Sept. 7, 1909. Railway signal system for electric cars.

1,016,499. ELECTRIC-CLOCK SYSTEM; R. D. Hickok, Atlanta, Ga. App. filed March 7, 1911. Setting and synchronizing.

1,016,524. ELECTRIC SAFETY FUSE; C. N. Sachs, Hartford, Conn. App. filed Jan. 16, 1905. Cartridge type with coiled-band fuse strip.

1,016,546. TELEPHONE RINGING APPARATUS; W. E. Butler, David City, Neb. App. filed April 30, 1910. Generating current; selective signaling.

1,016,564. BREAK KEY; J. L. Hogan, Jr., Brant Rock, Mass. App. filed Sept. 9, 1910. For wireless signaling.

1,016,567. SPRING-ARMATURE RELAY; W. Kaisling, Chicago, Ill. App. filed March 28, 1910. For telephone systems.

1,016,589. PUSH-BUTTON; H. C. Thomson, Boston, Mass. App. filed May 21, 1910. Improvement on switch of Patent No. 959,435.

1,016,617. TELEPHONE SYSTEM; W. A. Fricke, Chicago, Ill. App. filed May 10, 1909. Central energy exchange.

1,016,618. SYNCHRONIZING SYSTEM; W. A. Fricke, Chicago, Ill. App. filed Oct. 17, 1910. For time clocks.

1,016,646. ELECTRIC CARTRIDGE FUSE; F. W. A. Schneider, Toronto, Canada. App. filed June 6, 1911. Separate parts.

1,016,661. CIRCUIT-CONTROLLING APPARATUS; N. Wilkinson, Milwaukee, Wis. App. filed June 27, 1910. No-voltage and time-limit overload protection for potential starters.

1,016,699. SIGNALING DEVICE; R. H. Manson, Elyria, Ohio. App. filed Oct. 3, 1910. Noise horn.

1,016,670.—LISTENING DETECTOR FOR TELEPHONE LINES; E. Burgener, Wellesley, and C. Burgener, Linwood, Canada. App. filed Jan. 3, 1911. An electro-motor device signaling selectively to identify the subscribers using the line.

1,016,716. ELECTRICAL APPARATUS FOR DESTROYING INSECTS; F. S. Smith, Philadelphia, Pa. App. filed Aug. 22, 1911. Sterilizing articles in packages by disruptive discharge.

1,016,718. LAMP RECEPTACLE; J. S. Stewart, New York, N. Y. App. filed Feb. 27, 1911. Conduit or molding fitting.

1,016,728. ELECTRICAL FITTING; H. C. Barber, North Haven, Conn. App. filed July 26, 1911. Base and rosette.

1,016,747. TROLLEY; E. P. Hinchberger, Pittsburgh, Pa. App. filed June 17, 1911. Spring-pressed guard plates.

1,016,754. SYSTEM OF MOTOR CONTROL; L. J. Lingo, Jr., Wilmington Del. App. filed Oct. 5, 1911. Polyphase alternating-current motors with dynamic brake.

1,016,773. ARC LAMP; T. J. and W. H. Prisk, Johnstown, Pa. App. filed March 21, 1911. Carbon feed, converging.

1,016,774. COLLECTING DEVICE FOR DYNAMO-ELECTRIC MACHINES; H. H. Ralston, Norwood, Ohio. App. filed May 24, 1907. Spring brush feed.

1,016,780. INSULATOR; P. Rutzky, Crefeld, Germany. App. filed Feb. 15, 1910. Leading in and testing.

1,016,790. METHOD OF DESTROYING INSECTS; F. S. Smith, Philadelphia, Pa. App. filed Jan. 7, 1911. By disruptive discharge. (See apparatus patents above.)

1,016,793. RHEOSTAT; H. A. Steen, Milwaukee, Wis. App. filed Aug. 1, 1910. Stepped resistance.

1,016,794. SYSTEM OF MOTOR CONTROL; E. W. Stull, Milwaukee, Wis. App. filed July 20, 1910. Electrical inter-locks.

1,016,795. THERMOSTATIC REGULATOR; C. E. Teeters, Canal Dover, Ohio. App. filed April 27, 1911. For sadirons.

1,016,802. TROLLEY; C. F. Vensel, Jr., Chicora, Pa. App. filed March 17, 1910. Pivoted frame with two wheels.

1,016,804. MANUFACTURE OF METALLIC FILAMENTS FOR INCANDESCENT LIGHTING; C. H. Weber, Berlin, Germany. App. filed April 20, 1910. Tungsten with tellurium.

1,016,825. APPARATUS FOR PRODUCING A CONSTANT VOLTAGE WITH VARIABLE SPEED; H. Grob, Zurich, Switzerland. App. filed March 17, 1908. Train-lighting system, etc.

1,016,833. ELECTRIC-SWITCH CONTACT HOLDER; D. Larson, Yonkers, N. Y. App. filed May 7, 1908. Clamping jaws.

1,016,834. CONTROLLING MECHANISM; D. Larson, Yonkers, N. Y. App. filed July 18, 1911. For elevator motors, etc.; safety.

1,016,837. ELECTRIC-SWITCH CONTACT HOLDER; D. L. Lindquist and D. Larson, Yonkers, N. Y. App. filed May 7, 1908. Insulating bushing.

1,016,847. TERMINAL PLATE FOR TELEPHONE DESK STANDS; G. Nelson, New York, N. Y. App. filed Aug. 2, 1911. Contacts and insulation.

1,016,865. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; G. Winter and F. Eichberg, Vienna, Austria-Hungary. App. filed June 11, 1902. Commutator type.

1,016,866. ALTERNATING-CURRENT DYNAMO-ELECTRIC APPARATUS; G. Winter and F. Eichberg, Vienna, Austria-Hungary. App. filed June 11, 1902. Windings and circuit connections.

1,016,874. MEANS FOR PREVENTING DEPLETION OF ELECTROLYTE; T. A. Edison, Llewellyn Park, West Orange, N. J. App. filed June 21, 1911. Sealed storage battery.

1,016,875. ELECTROPLATING APPARATUS; T. A. Edison, Llewellyn Park, West Orange, N. J. App. filed July 28, 1911. For making composite sheets. (See Patents Nos. 865,687, 865,688 and 936,525.)

1,016,882. RAILWAY SIGNALING SYSTEM; T. M. Freeble, Rochester, N. Y. App. filed April 29, 1911. Rail block system.

1,016,919. CROSSING SIGNAL; T. A. Grist, Knox, Ind. App. filed Nov. 22, 1909. For electric railroads.

1,016,922. RAILWAY SIGNALING SYSTEM; L. V. Lewis and J. S. Holliday, Wilkinsburg, Pa. App. filed July 7, 1911. Alternating-current signals for electric railways.